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15
New
Franklin Arithmetic
First Book

SEEVER AND WALTON



SHELDON AND COMPANY
NEW YORK • CHICAGO

Educ T 118, 957, 763

Bk 1



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NEW FRANKLIN
ARITHMETIC

FIRST BOOK

[with ans.]

BY

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AGENT OF MASSACHUSETTS BOARD OF EDUCATION; AUTHOR OF
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NEW YORK AND CHICAGO
SHELDON AND COMPANY

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PREFACE.

THE New Franklin Arithmetics constitute a two-book series designed to cover all the book-work in arithmetic from the beginning to the end of the course for common schools. This First Book of the series includes the matter usually put into the first two books (primary and elementary) of a three-book series.

Assuming that the oral work in number (such as is usually carried on in the kindergarten and in the first year or two of the primary schools with abundant objective illustration) has been done, and that the children are now able to read simple language with some facility, this book offers, in Part I (pp. 1-84), a complete and systematic review of numbers from one to one hundred. Within this range are included all the sums, differences, products, and quotients resulting from the elementary combinations and separations of numbers. The method of treatment is that known as the Grube method. The work is kept as near as possible to the concrete. The pictorial illustrations are designed merely to suggest appropriate operations with real objects (blocks, etc.), and not at all to embellish the text. Incidentally, too, in this primary part, are given the elementary facts relative to the most commonly used weights and measures; and, towards the end, so much of written arithmetic as is involved in the addition and subtraction of tens and units.

The next stage of the work is presented in Part II (pp. 85-109), which illustrates the rules of written arithmetic as applied to numbers below ten thousand and to sums of United States Money (dollars and cents) within the same range of expression, four places.

The final stage is reached in Part III (pp. 110-140), which treats of numbers without limit. This part and the following parts (treating respectively of Common Fractions, Decimal Fractions, Percentage, Interest, and Mensuration) taken together afford a complete though

very elementary course of arithmetic. All the essentials of arithmetic are here included, and enough of the applications for the ordinary purposes of daily life. Such a course, it is believed, will meet the wants of that large number of children who leave school at about thirteen years of age, without reaching the higher grades of instruction; nor will it be without use to children who remain in school longer, if their work is arranged so as to give them a short and easy course in matters which they will study more thoroughly in a larger book later in their course. In accordance with this view the authors have been led to make the present book not only an introduction to the Second Book, but also to some extent an easy parallel to it. The transition from the First to the Second Book can readily be made at any point after the beginning of Part III. All that is strictly necessary as introductory matter to the Second Book is embraced in Parts I and II of this first book.

Among the special features of this book to which attention may be called are the constant use of oral exercises in connection with written work, so that the same form of analysis answers for both processes; the use of simple blank forms of answer, whereby is suggested the most direct and easiest course of thought in solving each question; the drill tables, by which a great abundance of examples is provided for class exercises and tests; the introduction of United States money and denominate numbers into every part of the book, so that the reductions of such numbers become a part of the ordinary practice in the fundamental operations; the recognition and appropriate explanation of the two forms of division known respectively as the measuring and the partitive form; and finally the simple, inductive, and thoroughly objective style of exposition which characterizes the whole book.

E. P. S.

G. A. W.

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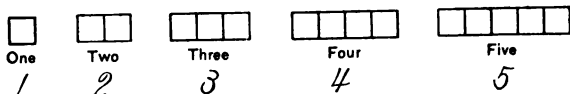
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FIRST BOOK.

PART I.

LESSON 1.

Numbers from One to Five.



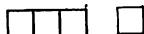
1. Copy or read, and fill out:

☐ ☐ One and one are — Two ones are —
One from two leaves —



Two and one are —

One and two are —



Three and one are —

One and three are —



Two and two are —

Two twos are —

One from three leaves —

Two from three leaves —


One from four leaves —

Three from four leaves —

Two from four leaves —

In four there are — twos

2. Here is a square. ☐


Here is a triangle. 

A square has — sides. A triangle has — sides.

I can make a square with — splints.

One splint taken from the square leaves — splints.

I can make a triangle with — splints.

3. Dora has . If she should give one of her pinks to Clara, she would have — left. If she should give two to Clara, she would have — left.

1. A square has — corners. A triangle has — corners.
A square has — more corner than a triangle.

Four is — more than three.

Three is — less than four.

☉ ☉ ☉ ☉ If I pick one strawberry and then pick three more, I shall have — strawberries.

Four is — more than one.

One is — less than four.

2. Etta had ☉ ☉ ☉ ☉, and Jane had ☉ ☉

Etta had — more apples than Jane.

Four is — more than two.

Two is — less than four.

Etta has separated her four ☉ ☉ ☉ ☉ into two equal parts. Each part is one half of four apples.

One half of four apples is — apples.

One half of is .

One half of four is —.

One half of is . One half of two is —.

3. In ☉ there are ☉ ☉ half apples.

I had ☉ and gave half of it to Jane. I then had — half-apple left.

One half from two halves leaves — half.

4. This line ————— is one inch long.

In one inch there are — half-inches.

This line ————— is — inches long. In two inches there are — half-inches.



In two circles there are — half-circles.

In two there are — halves.

5. Make the figures that stand for these numbers.

One	Two	Three	Four	Five
/	2	3	4	5

This figure, 0, called zero, stands for no number.

LESSON 3.

9

The Number Five.

1. Read, and fill out :


4 and 1 are —. 1 and 4 are —.
1 from 5 leaves —. 4 from 5 leaves —.

3 and 2 are —. 2 and 3 are —.
2 from 5 leaves —. 3 from 5 leaves —.

2 and 2 and 1 are —. Two 2's
and 1 are —. Two 2's from 5 leaves —. 2's in
5 — and — over.

2. What numbers put with each of the following
will make 5 :

2 1 3 4 0

3. Here is a pentagon.  It has — sides.

A pentagon has — more side than a square.

5 is — more than 4. 5 is — more than 1.



A pentagon can be made with — splints.




2 splints taken from the pentagon leaves — splints.

2 from 5 leaves —.

A triangle has — less sides than a pentagon.

5 less 2 are —. 5 less 3 are —.

4. If you have  , how many half-apples can you
make of them ?

In   and  how many half-apples are there ?

Mary had 2 pears and 1 half-pear, and Jane had 4
half-pears ; which girl had the greater number ?

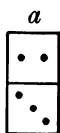
How many more are 5 cents than 3 cents ? How
many more are 5 than 1 ? How many more are 5
than 2 ?

If you have 5 cents and lose one, how many will you
have left ?

5 less 1 are how many ? 5 less 4 are how many ?

Exercises for Written Work.

1. How many dots are there on card
- a*
- ?



On the upper part of the card there are
— dots.

On the lower part of the card there are
— dots.

Write 2 and then write 3 under the 2.

$$\begin{array}{r} 2 \\ 3 \\ \hline 5 \end{array}$$

Three dots and 2 dots are — dots.

You have now **added** the 3 and 2.

Write 5 under the 3 with a line between.

2. Copy and add the dots on the cards below:



$$\begin{array}{r} 2 \\ 1 \\ \hline 3 \end{array}$$



$$\begin{array}{r} 3 \\ 1 \\ \hline \end{array}$$



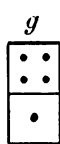
$$\begin{array}{r} 3 \\ 2 \\ \hline \end{array}$$



$$\begin{array}{r} 1 \\ 4 \\ \hline \end{array}$$



$$-$$



$$-$$



$$-$$



$$-$$

1 and 2 are 3, can be written $1+2=3$. The sign $+$ means *and*, and $=$ means *are*.

3. Copy and fill out:

$$2+2=?$$

$$2+3=?$$

$$2+1=?$$

$$4+1=?$$

$$3+1=?$$

$$1+3=?$$

$$1+2=?$$

$$1+4=?$$

$$3+2=?$$

4. How many days in the week do you go to school?
If you should miss going to school one day in the week,
how many days would you go?

1 day less than 5 days is — days.

If you learn to spell 2 words a day, how many
words do you learn in 2 days? I learn 2 words and
2 words or — words.

1. How many dots are there on card *a*?

a How many dots will be left if the dot on the lower half is rubbed out? 4 less 1 is —.

•
•
•
•

4 less 1 is 3, can be written, $4 - 1 = 3$.

The sign — means *less*.

Find how many dots will be left if the dots on the lower half of each card below are taken away.

<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>																																
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$4 - 1?$ $5 - 3?$ $3 - 2?$ $4 - 2?$ $4 - 3?$ $5 - 2?$ $5 - 1?$ $2 - 1?$

When you take part of a number away to find how many are left, you **subtract**.

2. At 2 cents apiece, how many lemons can you buy for 4 cents? I can buy — lemons.

There are — 2's in 4.

A nickel is — cents. For a nickel I can buy — 2-cent stamps and — 1-cent stamp.

If you should walk forward 5 steps and then walk backward 3 steps, how many steps forward would you be? I should be — steps forward.

A boy had splints enough to make one triangle and one side of another. How many splints had he? How many more splints must the boy get to make the other triangle? 1 and — more are 3.

3. How many oranges would it take to give one half of an orange to each of 2 boys? How many would it take to give one half to each of 4 boys?

2 halves equal how many wholes? 4 halves equal how many wholes?

Tell some things you can buy with a nickel.

Numbers from Six to Ten.



Six

6



Seven

7



Eight

8



Nine

9

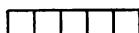


Ten

10

The Number Six.

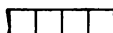
1. Read, and fill out:



$5 + 1 = ?$

$1 + 5 = ?$

$6 - 1 = ?$



$4 + 2 = ?$

$2 + 4 = ?$

$6 - 2 = ?$



$3 + 3 = ?$

Two 3's = ?

$\frac{1}{2}$ of 6 = ?



$2 + 2 + 2 = ?$

Three 2's = ?

2's in 6 = ?

2. Six blocks are — block more than 5 blocks.

Six blocks are — blocks more than 4 blocks.

Six blocks less 3 blocks are — blocks.

One half of 6 blocks is — blocks.

With 6 splints I can make — triangles.

3. Make two marks three times, thus II II II.

Three times 2 marks are — marks.

Three times 2 books are — books.

Make three marks two times, thus III III.

Two times 3 marks are — marks.

Two times 3 spools are — spools.

In 6 marks there are — times 2 marks.

In 6 marks there are — times 3 marks.

In 6 there is — four and — over.

In 6 there is — five and — over.

4. Draw the cards below, and put in the dots needed to make 6 dots on each card.



$4 + ? = 6$



$3 + ? = 6$



$? + 5 = 6$



$1 + ? = 6$



$? + 2 = 6$

LESSON 7.

18

The Number Seven.

1. Read, and fill out:

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	$6+1=?$	$1+6=?$	$7-1=?$
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	$5+2=?$	$2+5=?$	$7-2=?$
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	$4+3=?$	$3+4=?$	$7-3=?$

2. Five hats from 7 hats leaves — hats.
 Four balls from 7 balls leaves — balls.
 Seven inches less 6 inches equals — inch.

3. Draw the cards below and put in the dots needed to make 7 on each card.


<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
$4+?=7$	$3+?=7$	$?+5=7$	$1+?=7$	$?+2=7$	$?+6=7$

4. Lay 7 splints

- By 2's, thus, $\parallel \parallel \parallel \mid$ $7=2+2+2+?$
 By 3's, thus, $\equiv \equiv \equiv \mid$ $7=3+3+?$

In 7 there are — 2's and — over.
 In 7 there are — 3's and — over.
 In 7 there is — 4 and — over.

5. Mollie is 7 years old, Charles is 5 years old. The difference between 7 years and 5 years is — years.

6. Here is a hexagon. 

The hexagon has — sides and — corners.

To make a square and a triangle it takes — splints.



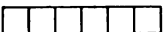

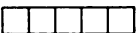

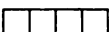





The hexagon has — more side than a pentagon. It has — more sides than a square. It has — more sides than a triangle.

A pentagon has — less side than a hexagon.

A square has — less sides than a hexagon.

The Number Eight.

1. Read, and fill out:

		$7+1=?$	$1+7=?$	$8-1=?$
		$6+2=?$	$2+6=?$	$8-2=?$
		$5+3=?$	$3+5=?$	$8-3=?$
		$4+4=?$	Two 4's = ?	$8-4=?$
				$2+2+2+2=?$ Four 2's = ?

2. Make 8 marks by 3's. III III II.

 $8=3+3+?$ In 8 there are — 3's and — over.

3. 5 blocks and 3 blocks are — blocks.

8 blocks less 6 blocks are — blocks.

8 blocks are 1 block more than — blocks.

2 times 4 blocks are — blocks.

4 times 2 blocks are — blocks.

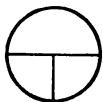
4 blocks in 8 blocks — times.

2 blocks in 8 blocks — times.

1 half of 8 blocks is — blocks.

After a boy had lost 2 marbles he had 6 marbles left.
How many marbles had he at first?

4. These beads ~~oo-oo-oo-oo~~ are divided into how many equal parts? One of these parts is 1 fourth of 8 beads. 1 fourth is written $\frac{1}{4}$. $\frac{1}{4}$ of 8 beads is — beads. $\frac{2}{4}$ of 8 beads are — beads. $\frac{3}{4}$ of 8 beads are — beads. $\frac{1}{4}$ of 8 sheep is — sheep. $\frac{3}{4}$ of 8 sheep are — sheep.



If $\frac{1}{2}$ of a circle is cut into 2 equal parts,
what part of the circle will one part be?

If $\frac{1}{2}$ and $\frac{1}{4}$ of a cake are eaten, what part
of the cake remains?

 $\frac{1}{2}$ equals how many fourths?

LESSON 9.

15

1. Give at sight, or copy and fill out:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
$5+2=?$	$2+3=?$	$2+5=?$	$4+2=?$
$2+6=?$	$1+7=?$	$6+1=?$	$3+5=?$
$3+3=?$	$1+6=?$	$1+5=?$	$3+4=?$
$2+4=?$	$7+1=?$	$1+2=?$	$1+3=?$
$4+3=?$	$5+1=?$	$6+2=?$	$4+1=?$

<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
$4-1=?$	$4-2=?$	$2-1=?$	$8-5=?$
$7-2=?$	$3-2=?$	$8-3=?$	$7-4=?$
$3-1=?$	$6-3=?$	$7-3=?$	$6-4=?$
$8-4=?$	$8-7=?$	$5-3=?$	$6-1=?$
$7-6=?$	$7-5=?$	$6-5=?$	$8-7=?$

<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>
$2+1=?$	$6-2=?$	$5+3=?$	$8-3=?$
$1+1=?$	$6+2=?$	$5-4=?$	$3+2=?$
$1-1=?$	$5-2=?$	$3+4=?$	$7-3=?$
$3+1=?$	$8-6=?$	$4+4=?$	$4+2=?$

2. Name the days of the week. There are — days in all.

Take the school days from the week. How many days are left?

Carl and John together wear — pairs of shoes.

Four boys need — pairs of shoes. In 4 pairs there are — shoes.

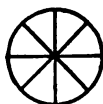
A horse wears — shoes. To shoe a span of horses requires — shoes.

An ox wears 2 shoes on each foot.

The ox wears — shoes in all.

5 acorns and 2 acorns are how many acorns?

7 goats less 3 goats are how many goats?



1. If each half of a circle is cut into 4 equal parts the circle will be cut into — equal parts.

Each of the parts is 1 eighth of the circle.

1 eighth is written $\frac{1}{8}$.

In $\frac{1}{2}$ of a circle there are — eighths. $\frac{1}{2} = \frac{4}{8}$.

In $\frac{1}{4}$ of a circle there are — eighths. $\frac{1}{4} = \frac{2}{8}$.

In $\frac{3}{4}$ of a circle there are — eighths. $\frac{3}{4} = \frac{6}{8}$.



2. A figure 3 squares long and 2 squares wide contains — squares.

In half of this figure there are — squares.

Draw a figure 4 squares long and 2 squares wide.

This figure contains — squares.

Draw a square figure that contains 4 squares. This figure is — squares long and — squares wide.

One sash of a window has 2 rows of panes, 3 panes in a row. In the whole sash there are — panes.

A window sash has 8 panes, 4 panes in a row. In the sash there are — rows of panes.



3. The common house fly has — legs; the spider has — legs. How many pairs of legs does the fly have? How many pairs

does the spider have?

The spider has — more legs than



the fly.

The bee has — legs and — wings. How many less legs has the bee than the spider?

How many more wings has the bee than the fly?

How many more wings has the bee than the spider?

4. Dick has 2 rabbits; Frank has half as many. How many rabbits have both together?

Willie has twice as many rabbits as Dick. How many has Willie? How many do all the boys have together?

LESSON 11.

17

Exercises in Adding and Subtracting.

1. Write the number of dots in each part of a block, and then write the whole number beneath, as you were told to do in Lesson 4.

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>

Add the following :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>
2.	$\begin{array}{r} 1 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ 2 \\ \hline \end{array}$
3.	$\begin{array}{r} 3 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ 6 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ 4 \\ \hline \end{array}$
4.	$\begin{array}{r} 4 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ 4 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ 2 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ 1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ 3 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ 5 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ 6 \\ \hline \end{array}$

Subtract the following :

		<i>l</i>	<i>m</i>	<i>n</i>	<i>o</i>	<i>p</i>	<i>q</i>	<i>r</i>	<i>s</i>	<i>t</i>
5.	From	3	7	5	4	7	6	8	6	7
	Take	$\begin{array}{r} 1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \hline \end{array}$
6.	From	3	4	6	5	7	8	5	8	6
	Take	$\begin{array}{r} 2 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \hline \end{array}$
7.	From	8	7	8	6	5	8	7	8	7
	Take	$\begin{array}{r} 1 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ \hline \end{array}$

8. A grocer sold 4 bunches of matches at 2 cents a bunch. How much did he get for all?

LESSON 12.

Liquid Measures.

Dry Measures.



1 gill.



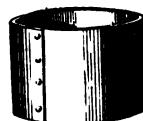
1 pint.



1 quart.



1 pint.



1 quart.

1. Fill the gill measure with water or sand and empty it into the pint measure.

How many gills does it take to fill the pint measure?

How many pints does it take to fill the quart measure?

In 1 pint there are — gills; in 2 pints there are — gills.

2.

4 gills make 1 pint.

2 pints make 1 quart.

8 gills make 1 quart.

3. With a quart of milk I can fill — pint bowls.

When a pint bowl is half full, there are — gills in the bowl. It will take — more gills to fill it.

If I have a quart of milk, I can give 1 gill apiece to — children.

When a quart measure is half full, it will take — more gills to fill it. In $\frac{1}{2}$ quart there are — gills.

In $\frac{1}{4}$ quart there are — gills. $\frac{1}{2}$ quart + $\frac{1}{4}$ quart = — gills.

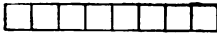

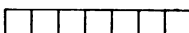

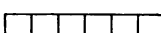

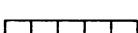
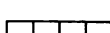


If from a quart measure 6 gills are taken, — gills are left. What part of a quart is 2 gills? is 4 gills?

In $1\frac{1}{2}$ quarts there are — pints. In $2\frac{1}{2}$ quarts there are — pints. In $3\frac{1}{2}$ quarts there are — pints.

When berries are 8 cents a quart, a pint will cost — cents. A half-pint will cost — cents.

The Number Nine.

1. Read, and fill out :

		$8+1=?$	$1+8=?$	$9-8=?$
		$7+2=?$	$2+7=?$	$9-7=?$
		$6+3=?$	$3+6=?$	$9-6=?$
		$5+4=?$	$4+5=?$	$9-5=?$
		$3+3+3=?$	$9-3-3-3=?$	

2. 5 blocks and — blocks are 9 blocks.

7 blocks are — less than 9 blocks.

9 blocks less 3 blocks are — blocks.

1 block is — less than 9 blocks.

3. Make 9 marks

By 2's, thus $\parallel \parallel \parallel \parallel \parallel$ $9=2+2+2+2+?$

By 4's, thus $\lll \lll \parallel$ $9=4+4+?$

4 times — blocks + 1 block = 9 blocks.

2 times — blocks + 1 block = 9 blocks.

2 blocks in 9 blocks — times and — over.

4 blocks in 9 blocks — times and — over.

4. These beads $\circ-\circ-\circ-\circ-\circ-\circ-\circ-\circ-\circ$ are divided into — equal parts. One of these parts is 1 third of 9 beads. 1 third is written $\frac{1}{3}$.

$\frac{1}{3}$ of 9 beads is — beads. $\frac{2}{3}$ of 9 beads are — beads.

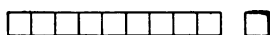
5. Draw a line 1 inch long ——— Divide it into three equal parts. One of these equal parts is one — of an inch. In 1 inch there are — thirds.

How many thirds are there in 1 apple? In 2 apples? In 3 apples?

To give 9 children $\frac{1}{3}$ of an apple apiece I must have — apples.

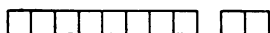
The Number Ten. 10.

1. Read, and fill out :



$9 + 1 = ?$

$10 - 1 = ?$

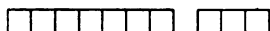


$1 + 9 = ?$

$10 - 9 = ?$

$8 + 2 = ?$

$10 - 2 = ?$



$2 + 8 = ?$

$10 - 8 = ?$

$7 + 3 = ?$

$10 - 3 = ?$



$3 + 7 = ?$

$10 - 7 = ?$

$6 + 4 = ?$

$10 - 4 = ?$



$4 + 6 = ?$

$10 - 6 = ?$

$5 + 5 = ?$

$10 - 5 = ?$

$\text{Two } 5\text{'s} = ? \quad \frac{1}{2} \text{ of } 10 = ?$

2. 10 blocks are — more blocks than 2 blocks.

2 times 5 blocks are — blocks.

3. Make 10 marks

By 2's, thus, || || || || ||

$10 = 2 + 2 + 2 + 2 + ?$

By 3's, thus, ||| ||| ||| |

$10 = 3 + 3 + 3 + ?$

By 4's, thus, |||| |||| ||

$10 = 4 + 4 + ?$

4. These beads ~~oo oo oo oo oo~~ are divided into — equal parts. One of the parts is 1 fifth of 10 beads. 1 fifth is written $\frac{1}{5}$.

$\frac{1}{5}$ of 10 beads is — beads. $\frac{2}{5}$ of 10 beads are — beads.

$\frac{3}{5}$ of 10 beads are — beads. $\frac{4}{5}$ of 10 beads are — beads.

Supply the missing numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>
5.	7	5	?	8	?	?	2	?	1
	?	?	3	?	5	9	?	4	?
	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$
	?	1	6	9	7	3	?	4	?
6.	5	6	?	?	2	?	7	?	8
	$\frac{\quad}{10}$	$\frac{\quad}{?}$	$\frac{\quad}{10}$	$\frac{\quad}{10}$	$\frac{\quad}{?}$	$\frac{\quad}{8}$	$\frac{\quad}{10}$	$\frac{\quad}{9}$	$\frac{\quad}{10}$

1. How many legs have 2 three-legged stools and a chair?

2. From 10 gills take a quart. How many gills remain?

3. How many castors must be had for the front legs of 5 chairs?

4. How many 2-cent oranges can be bought for 10 cents?

5. Olive has a dime, and Grace has half as much money as Olive. How much money has Grace?

6. Sarah had a dime, and paid 3 cents for an orange and 2 cents for a pear. How many cents had she left?

7. If you have a dime and spend it for pens at 1 cent each, how many pens can you buy?

8. If you buy with the dime 4 pens at 1 cent each, how many cents will you have left?

9. A dime equals how many nickels?

10. What can you get for a dime?

I can get 5 pens at — cents each.

I can get — car fares at 5 cents each.

I can get three 2-cent stamps and — 1-cent stamps.

11. Tell other things you can buy with a dime.

12. What change will be left from a dime,

If you buy 2 oranges at 4 cents apiece?

If you buy 3 firecrackers at 3 cents apiece?

If you buy 2 bananas at 3 cents apiece?

13. If you have 10 splints and make first a square, what other two figures can you make with the splints that are left?

14. Ruth is 8 years old, and Ellen is 6. When Ruth is 10 years old, how old will Ellen be?

15. 10 dimes make a dollar. How many dimes are there in a half-dollar?

1. Copy or read, and fill out:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
$1+1=?$	$3+1=?$	$4+?=5$	$5+1=?$
$1+2=?$	$?+2=4$	$?+2=5$	$4+?=6$
	$1+?=4$	$2+?=5$	$?+3=6$
<i>h</i>		$1+?=5$	$2+4=?$
$9+1=?$	<i>g</i>		$?+5=6$
$?+2=10$	$8+1=?$	<i>f</i>	
$7+?=10$	$7+2=?$	$7+?=8$	<i>e</i>
$6+4=?$	$6+?=9$	$?+2=8$	$6+?=7$
$?+5=10$	$?+4=9$	$5+?=8$	$5+2=?$
$4+?=10$	$4+5=?$	$4+4=?$	$4+?=7$
$3+7=?$	$3+?=9$	$3+?=8$	$?+4=7$
$2+?=10$	$?+7=9$	$2+?=8$	$2+?=7$
$?+9=10$	$1+?=9$	$1+?=8$	$1+?=7$

2. Count by 1's to 10; thus, 1, 2, 3, 4, etc.

Count by 2's to 10; thus, 2, 4, 6, etc.

Count by 2's from 1 to 9; thus, 1, 3, 5, etc.

Count by 3's to 9. Count by 3's from 1 to 10.

3. Copy and fill out:

One 2 is —.

One 3 is —.

Two 2's are —.

Two 3's are —.

Three 2's are —.

Three 3's are —.

Four 2's are —.

One 4 is —.

Five 2's are —.

Two 4's are —.

Ten 1's are —.

One 5 is —.

Two 5's are —.

Uniting equal numbers in this way is **multiplying**.

4. You may now repeat what you have written about 2's; 3's; 4's; 5's.

1. Read, and fill out :

In 4 there are — 2's.

In 5 there are — 1's.

In 8 there are — 2's.

In 6 there are — 3's.

In 10 there are — 2's.

In 2 there is — 2.

In 9 there are — 3's.

In 10 there are — 5's.

In 8 there are — 4's.

In 6 there are — 2's.

2. $\frac{1}{2}$ of 6 is —. 3 is $\frac{1}{2}$ of —. $\frac{1}{4}$ of 4 = ?
 $\frac{1}{3}$ of 6 is —. 2 is $\frac{1}{3}$ of —. $\frac{3}{4}$ of 4 = ?
 $\frac{1}{2}$ of 4 is —. 2 is $\frac{1}{2}$ of —. $\frac{2}{3}$ of 3 = ?
 $\frac{1}{4}$ of 8 is —. 2 is $\frac{1}{4}$ of —. $\frac{2}{3}$ of 6 = ?
 $\frac{1}{5}$ of 5 is —. 3 is $\frac{1}{3}$ of —. $\frac{2}{3}$ of 9 = ?
 $\frac{1}{3}$ of 9 is —. 4 is $\frac{1}{2}$ of —. $\frac{1}{5}$ of 10 = ?
 $\frac{1}{2}$ of 8 is —. 2 is $\frac{1}{5}$ of —. $\frac{3}{5}$ of 10 = ?

3. How many 2's are there in 5? in 6? in 7? in 9?

How many 3's are there in 7? in 8? in 10?

How many 4's are there in 8? in 9? in 6? in 10?

4. Add the following from below upwards :

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>	<i>m</i>
3	3	1	3	2	2	6	1	3	4	2	4	5
1	2	0	1	4	6	2	4	1	2	5	2	4
1	1	9	5	2	0	1	3	4	2	1	3	0
3	5	5	6	1	3	1	8	1	0	5	4	2
0	1	4	1	7	1	7	0	8	7	4	3	5
4	2	0	3	2	6	1	2	1	3	1	1	2

5. Supply the missing numbers:

4	3	2	?	6	5	2	3	4	1	0	?	5
1	4	1	4	?	1	?	?	2	4	4	5	?
?	?	7	3	2	?	0	6	3	?	?	2	4
7	9	?	10	9	8	9	10	?	7	10	9	10

1. Rob spent 5 cents, and then had 4 cents left. He had at first — cents.

2. Ralph gave 3 dates to his brother, 3 to his sister, and 4 to his mother. He gave to all — dates.

3. Ralph's mother gave half of her dates back to Ralph. Ralph then had 1 half of 4 dates. 1 half of 4 dates is — dates.

4. Nina had 9 dolls, and gave away 3 of them. She had — dolls left.

5. 1 third of Nina's dolls were new, and the rest were old. — dolls were old.

6. If one letter stamp costs 2 cents, 5 letter stamps will cost 5 times — cents. 5 times — cents are — cents.

7. A fly has 1 pair of wings. A bee has twice as many wings. Twice 2 wings are — wings.

8. A spider has — legs. A fly has — legs. A spider has — more legs than a fly.

9. In 1 pint there are — gills. In 2 pints there are 2 times — gills. 2 times — gills are — gills.

10. In 1 quart there are — pints; in 4 quarts there are 4 times — pints. 4 times — pints are — pints.

11. If 2 apples cost 6 cents, 1 apple will cost 1 half of 6 cents. $\frac{1}{2}$ of 6 cents is — cents.

12. If 3 cents will buy 6 figs, 1 cent will buy 1 third of 6 figs.

$\frac{1}{3}$ of 6 figs is — figs. $\frac{2}{3}$ of 6 figs is — figs.

13. If 4 cents will buy 8 roses, 1 cent will buy 1 fourth of 8 roses. $\frac{1}{4}$ of 8 roses is — roses.

14. Two nickels equal 1 dime; 1 nickel equals 1 half of a dime. $\frac{1}{2}$ of a dime equals — cents.

15. Mary can buy 2 pictures for 5 cents. With a dime she can buy — pictures.

1. Three boys paid 2 cents apiece for a ride. How many cents did all pay?

2. Arthur needed a slate, and had no money to buy one with, so 5 of his classmates gave 2 cents apiece and bought him one. How much did they pay for the slate?

3. Emma had two 2-cent peaches and three 1-cent peaches. How many cents' worth of peaches did she have?

4. How many cents' worth are three 2-cent postage stamps and two 1-cent stamps? How many cents' worth are four 2-cent stamps and a 1-cent stamp?

5. How many 2-cent stamps can you buy for 6 cents? How many for 8 cents? for 10 cents?

6. It takes a 5-cent stamp to send a letter to England. How many letters can you send there for 10 cents?

7. Emma bought a postage stamp for England and a 2-cent stamp for Buffalo, and then had 3 cents left. How many cents did she have at first?

8. If I can buy 2 cookies for a cent, how many cookies can I buy for 4 cents? for 5 cents?

9. Bananas cost me 2 cents apiece, and I have 9 cents. How many bananas can I buy with the money, and how many cookies with the money I have left?

10. How many wings do 5 flies have?

11. How many wings do 2 bees have?

12. 4 eggs from 9 eggs leaves how many eggs?

13. Sarah had 10 words in her spelling lesson and missed five. What part of her lesson did she spell right?

14. Dora missed 3 words out of her 10. How many did she spell right?

1. A man bought milk at 5 cents a quart, and sold it at 8 cents a quart. How much did he gain on 1 quart? The man gained — cents on 1 quart.

How much did he gain on 2 quarts? on 3 quarts? On 2 quarts he gained 2 times — cents, which is — cents. On 3 quarts he gained 3 times — cents, which is — cents.

2. Mrs. Breen paid 6 cents for a cake of soap: she paid 4 cents more for Minnie's doll than she paid for the soap. How much did she pay for the doll?

3. At 3 cents a pint, how many pints of milk can be bought for 9 cents? In 9 cents there are — times 3 cents. I can get — pints for 9 cents.

4. How many quarts are there in 3 pints?

2 pints make a quart. In 3 pints there is — quart and — pint.

5. Ada found a 4-leaved clover. How many 3-leaved clovers must be put with it to make 10 leaves?

Read and fill out:

6. 1 pint = — gills.

7. 1 quart = — gills.

$\frac{1}{2}$ pint = — gills.

$\frac{1}{2}$ quart = — gills.

$\frac{1}{4}$ pint = — gill.

$\frac{1}{4}$ quart = — gills.

$\frac{3}{4}$ pint = — gills.

$\frac{3}{4}$ quart = — gills.

8. Tell or write something about 3 trees and 2 trees. About 3 hats and 2 hats and 4 hats.

9. Tell or write something about dogs, or sheep, or hens, doves, rabbits, kittens, dolls, pinks, boots, aprons, books, oranges, or ribbon, using the following numbers:

$$4 + 4$$

$$2's \text{ in } 10$$

$$2 \times 3$$

$$\frac{1}{3} \text{ of } 6$$

$$5 + 3$$

$$2 \text{ dimes}$$

$$2 \times 5$$

$$\frac{1}{4} \text{ of } 8$$

$$9 - 3$$

$$4 + 2 + 3$$

$$3 \times 3$$

$$\frac{1}{5} \text{ of } 10$$

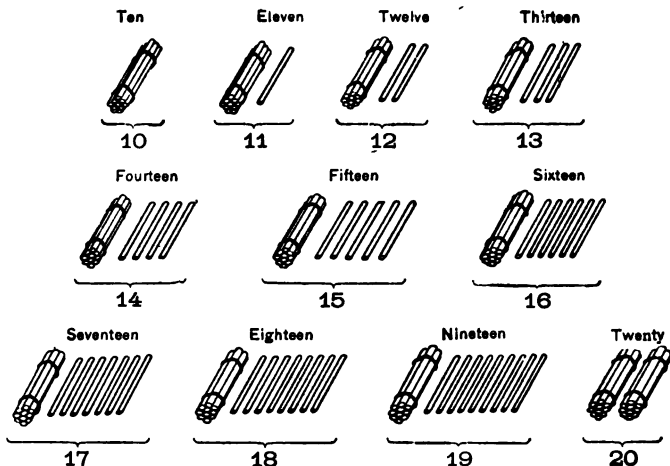
$$10 - 6$$

$$6 - 2 - 2$$

$$\frac{1}{2} \text{ of } 4$$

$$\frac{1}{3} \text{ of } 9$$

Numbers from Ten to Twenty.



Read, and fill out :

1

11 = 1 ten and 1 one.
 12 = — ten and — ones.
 13 = — ten and — ones.
 14 = — ten and — ones.
 15 = — ten and — ones.

2

16 = — ten and — ones.
 17 = — ten and — ones.
 18 = — ten and — ones.
 19 = — ten and — ones.
 20 = — tens.

3. How many ones will be left if 10 is taken from 12? from 13? from 15? from 17? from 18? from 20?

4. How many tens and how many ones are there in 15? in 17? in 19? in 11? in 16? in 12?

5. How many tens are there in 20?

6. How many are

10 canes and 6 canes?
 10 books and 5 books?
 10 spoons and 1 spoon?
 1 spoon from 11 spoons?

7. How many are

10 girls and 8 girls?
 10 girls from 18 girls?
 10 forks and 7 forks?
 10 forks from 17 forks?

1. How many are

- 10 blocks and 4 blocks?
- 14 blocks less 4 blocks?
- 10 boys and 3 boys?
- 13 boys less 10 boys?
- 10 hats and 6 hats?
- 15 hats less 10 hats?
- 10 balls and 2 balls?
- 12 balls less 10 balls?

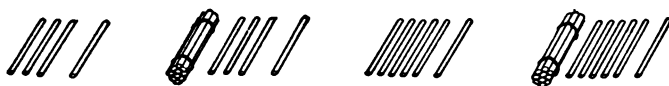
2. How many are

- 14 boys less 10 boys?
- 12 caps less 2 caps?
- 10 days and 9 days?
- 19 days less 10 days?
- 16 hats less 6 hats?
- 10 hats and 7 hats?
- 17 hats less 7 hats?
- 17 hats less 10 hats?

3. How many cents are there

- In 1 dime and 1 cent.
- In 1 dime and 2 cents.
- In 1 dime and 5 cents.
- In 1 dime and 7 cents.

- In 1 dime and 4 cents.
- In 1 dime and 9 cents.
- In 1 dime and 8 cents.
- In 1 dime and 10 cents.



4. How many are 3 and 1? 13 and 1? 5 and 1? 15 and 1?

5. How many are 4 and 2? 14 and 2? 6 and 2? 16 and 2?

6. How many are 7 and 2? 17 and 2? 3 and 3? 13 and 3?

7. How many are 2 and 7? 12 and 7? 1 and 8? 11 and 8?



8. How many are 3 less 1? 13 less 1? 5 less 2? 15 less 2?

9. How many are 4 less 2? 14 less 2? 6 less 3? 16 less 3?

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
2	3	1	2	1	3	4	5	6	3
<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>18</u>	<u>15</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>16</u>
3	5	3	6	5	7	2	2	4	2
12	14	17	13	12	11	17	14	16	15

<u>13</u>	<u>14</u>	<u>15</u>	<u>18</u>	<u>17</u>	<u>18</u>	<u>15</u>	<u>19</u>	<u>14</u>	<u>18</u>
2	3	1	5	4	2	3	4	2	3
<u>19</u>	<u>17</u>	<u>16</u>	<u>15</u>	<u>19</u>	<u>19</u>	<u>17</u>	<u>18</u>	<u>16</u>	<u>17</u>
6	2	1	4	2	7	3	1	4	5

3. Addition :

16	11	?	13	?	?	6	3	5	?
<u>?</u>	<u>4</u>	<u>2</u>	<u>?</u>	<u>1</u>	<u>14</u>	<u>12</u>	<u>?</u>	<u>?</u>	<u>3</u>
17	?	17	16	14	18	?	19	16	18
?	4	?	1	5	4	?	7	?	?
<u>19</u>	<u>?</u>	<u>12</u>	<u>?</u>	<u>?</u>	<u>?</u>	<u>15</u>	<u>?</u>	<u>18</u>	<u>4</u>
20	17	14	15	20	14	19	19	20	16

<u>17</u>	<u>?</u>	<u>15</u>	<u>18</u>	<u>19</u>	<u>?</u>	<u>18</u>	<u>16</u>	<u>?</u>	<u>19</u>
<u>?</u>	<u>3</u>	<u>2</u>	<u>?</u>	<u>?</u>	<u>1</u>	<u>?</u>	<u>?</u>	<u>6</u>	<u>3</u>
<u>11</u>	<u>13</u>	<u>?</u>	<u>11</u>	<u>10</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>12</u>	<u>?</u>
<u>?</u>	<u>14</u>	<u>17</u>	<u>?</u>	<u>15</u>	<u>16</u>	<u>?</u>	<u>17</u>	<u>?</u>	<u>16</u>
<u>5</u>	<u>?</u>	<u>?</u>	<u>3</u>	<u>?</u>	<u>?</u>	<u>5</u>	<u>?</u>	<u>4</u>	<u>?</u>
<u>11</u>	<u>13</u>	<u>10</u>	<u>16</u>	<u>13</u>	<u>13</u>	<u>14</u>	<u>12</u>	<u>14</u>	<u>12</u>

1. Archie had 5 cents, and Frank had 15 cents. How many more cents had Frank than Archie?

Archie earned 3 cents, and Frank earned 3 cents. Archie then had — cents, and Frank had — cents.

5 and 3 are —. 15 and 3 are —.

2. Mollie is 13 years old; her brother Fred is only 3. In 2 years Fred will be —, and Mollie will be —.

3 and 2 are —. 13 and 2 are —.

3. There are 4 cows in one pasture, and 14 cows in another. If 5 more cows are turned into each pasture, there will be in the first pasture — cows, and in the second pasture — cows.

4 and 5 are —. 14 and 5 are —.

4. Porte has 1 book, and Luke has 11 books. If each should have a gift of 6 books, Porte would then have — books, and Luke would have — books.

1 and 6 are —. 11 and 6 are —.

5. James bought a cap for 7 dollars, and a coat for 17 dollars; but he found that he had paid 2 dollars for each more than it was worth. The cap was then worth — dollars, and the coat was worth — dollars.

2 from 7 leaves —. 2 from 17 leaves —.

6. 9 gills were in one pail and 19 gills in another, when 6 gills were taken from each. There then remained in the first pail — gills, and in the second pail — gills.

8 from 9 leaves —. 8 from 19 leaves —.

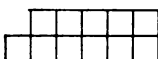
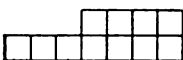
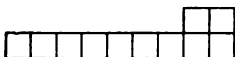
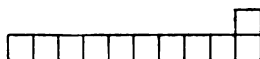
7. A man who had 12 cows bought 7 more. He then had — cows.

8. Last year my orchard yielded 18 barrels of apples. This year it yielded 8 barrels, which is — barrels less than it yielded last year.

8 is — less than 18.

The Number Eleven. 11.

1. Copy or read, and fill out:



$10 + 1 = ?$

$1 + 10 = ?$

$9 + 2 = ?$

$2 + 9 = ?$

$8 + 3 = ?$

$3 + 8 = ?$

$7 + 4 = ?$

$4 + 7 = ?$

$6 + 5 = ?$

$5 + 6 = ?$

$11 - 1 = ?$

$11 - 10 = ?$

$11 - 2 = ?$

$11 - 9 = ?$

$11 - 3 = ?$

$11 - 8 = ?$

$11 - 4 = ?$

$11 - 7 = ?$

$11 - 5 = ?$

$11 - 6 = ?$

2. Name in order the pairs of numbers that make 11. Thus, 10 and 1; 9 and 2; 8 and 3, etc.

3. Supply the missing numbers:

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
5	9	4	7	6	?	?	5	?	?
?	?	?	?	?	8	3	?	2	7
<u>11</u>	<u>11</u>	<u>11</u>	<u>11</u>	<u>11</u>	<u>11</u>	<u>11</u>	<u>11</u>	<u>11</u>	<u>11</u>

4. From 11 11 11 11 11 11 11 11 11
 Take 6 4 8 2 7 9 3 5

5. Make 11 marks by 2's; by 3's; by 4's; by 5's; then read, and fill out:

6.

$11 = 2 \times 5 + ?$

$11 = 3 \times 3 + ?$

$11 = 4 \times 2 + ?$

$11 = 5 \times 2 + ?$

7.

2 in 11 — times and — over.

3 in 11 — times and — over.

4 in 11 — times and — over.

5 in 11 — times and — over.

The Number Twelve. 12.

1. Copy or read, and fill out:

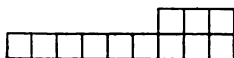


$10 + 2 = ?$

$12 - 2 = ?$

$2 + 10 = ?$

$12 - 10 = ?$

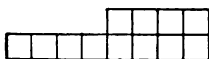


$9 + 3 = ?$

$12 - 3 = ?$

$3 + 9 = ?$

$12 - 9 = ?$

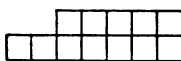


$8 + 4 = ?$

$12 - 4 = ?$

$4 + 8 = ?$

$12 - 8 = ?$

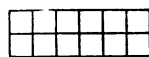


$7 + 5 = ?$

$12 - 5 = ?$

$5 + 7 = ?$

$12 - 7 = ?$



$6 + 6 = ?$

$12 - 6 = ?$

$\text{Two } 6\text{'s} = ?$

$6\text{'s in } 12 = ?$

2. Make 12 marks by 2's; by 3's; by 4's; by 5's; by 6's; then copy or read, and fill out.

3. $12 = 2 \times ?$

4. 2 in 12 — times.

$12 = 3 \times ?$

3 in 12 — times.

$12 = 4 \times ?$

4 in 12 — times.

$12 = 5 \times 2 + ?$

5 in 12 — times and — over.

$12 = 6 \times ?$

6 in 12 — times.

5. Lay 12 splints in pairs. How many pairs of splints have you laid?

6. Fill out the following:

With 12 splints, I can make — pairs of splints.

I can make — triangles.

I can make — squares.

I can make — hexagons.

I can make — pentagons and have — splints left.

To make 2 triangles and a square, I must have — splints.

To make a triangle and 2 squares, I must have — splints.

1. Name the months of the year.
2. In a year there are — months; in half a year there are — months; in one fourth of a year there are — months.

12 things make 1 dozen.

3. Count out one dozen splints ///////////////////////////////////////////////////////////////////.
4. Take up $\frac{1}{2}$ of the dozen splints. How many have you taken up? How many are there in $\frac{1}{2}$ of 12?
5. Take up $\frac{1}{3}$ of the dozen splints; take $\frac{2}{3}$ of the dozen. How many are $\frac{1}{3}$ of 12? $\frac{2}{3}$ of 12?
6. Take up $\frac{1}{4}$ of the dozen splints; take $\frac{3}{4}$ of the dozen; take $\frac{3}{4}$ of the dozen.
7. How many are $\frac{1}{4}$ of 12? $\frac{2}{4}$ of 12? $\frac{3}{4}$ of 12?
8. Now find from your splints, how many there are in $\frac{1}{6}$ of 12; in $\frac{2}{6}$ of 12; in $\frac{3}{6}$ of 12; in $\frac{4}{6}$ of 12; in $\frac{5}{6}$ of 12.

Read and fill out:

9. $\frac{1}{2}$ of 12 = —; $\frac{1}{3}$ of 12 = —; $\frac{1}{2}$ of 12 + $\frac{1}{3}$ of 12 = —.
10. $\frac{1}{3}$ of 12 = —; $\frac{1}{4}$ of 12 = —; $\frac{1}{3}$ of 12 + $\frac{1}{4}$ of 12 = —.
11. $\frac{1}{4}$ of 12 = —; $\frac{1}{6}$ of 12 = —; $\frac{1}{4}$ of 12 + $\frac{1}{6}$ of 12 = —.
12. What part of 12 is 6? What part of 12 is 4? is 3? is 2?

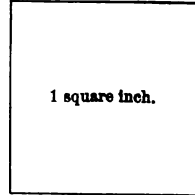
Name the spring months; the summer months.

13. What part of a year are the summer months?
14. What part of a year are the spring and summer months together?
15. How many are $3+3+3+3$? $2+6+4$?
16. How many are $3+4+5$? $7+5-3-2$?
17. How many are $12-2-4-2$? $12-5-2-4$?
18. Name any three numbers that added together make 12.

1. How long is this line? _____

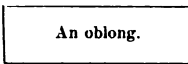
Make some of your splints 1 inch long. With 4 of the splints make a square.

2. Draw this square. This figure is a square inch.



3. Cut a square inch out of paper.

4. Cut out a four-sided figure which is longer than

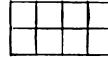


it is wide, and which has square corners. Such a figure is an oblong.

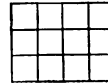
5. Draw an oblong 2 inches long, and 1 inch wide. How many square inches does it contain?



6. Draw or cut an oblong 4 inches long and 2 inches wide. This oblong contains — times 4 square inches, or — square inches.



7. An oblong 4 inches long and 3 inches wide contains — times 4 square inches, or — square inches.



8. An oblong 3 inches long and 4 inches wide contains — times 3 square inches or — square inches.

9. Is there any difference between 3×4 and 4×3 ?

10. Mark off 12 inches on a straight-edged strip of paper to be used for a measure.

12 inches make 1 foot.

11. Hold your hands 1 foot apart. Hold your hand a foot above your desk.

12. Measure off 3 feet on the floor.

3 feet make 1 yard.

13. How many square yards does a rug contain that is 3 yards long and 2 yards wide?

14. How many square feet are there in a flagstone that is 6 feet long and 2 feet wide?

1. Alice found 8 eggs in one nest and 4 eggs in another nest. She found — eggs in all.

2. Archibald raised a brood of 12 chickens. He sold 3 of them and had — left.

3. To make 12 days it takes a week and — days.

4. A dozen eggs at 1 cent each will cost — cents. A half-dozen will cost — cents. 3 eggs = — of a dozen.

5. In 1 quart of milk there are — gills. In 1 pint there are — gills. In 1 quart and 1 pint there are — gills. At 8 cents a quart 1 gill will cost — cent.

6. John has 12 cents, and Harry has 7 cents. How many more cents has John than Harry?

7. If you have a 5-cent piece and 3 cents, how many more cents must you have to pay for a top worth 11 cents?

8. Emma is to pick 12 roses for the table. After she has picked 2 white roses and 7 red roses, how many more roses has she to pick?

9. If you have 2 pears and 12 apples, and eat 1 of each, how many pears will you have left? How many apples? How many are $2-1$? $12-1$? $12-11$?

10. Divide 12 apples equally among 4 girls. How many will each have?

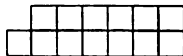
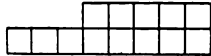
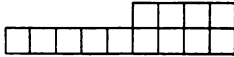
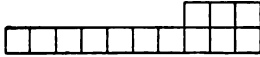
11. Divide 12 pecan nuts equally among 3 girls. Divide $\frac{1}{2}$ of 12 pecan nuts among 6 girls.

12. Tell what you can buy for 12 cents.

For 12 cents I can buy — 2-cent tops; or I can buy — 4-cent oranges; or — 3-cent peaches; or — 2-cent apples; or — 1-cent stamps; or — 5-cent dolls, and have — cents left.

13. Tell some other things that you can buy with 12 cents.

The Number Thirteen. 13.



1. $10 + 3 = ?$ $13 - 10 = ?$
 $3 + 10 = ?$ $13 - 3 = ?$
 $9 + 4 = ?$ $13 - 9 = ?$
 $4 + 9 = ?$ $13 - 4 = ?$
 $8 + 5 = ?$ $13 - 8 = ?$
 $5 + 8 = ?$ $13 - 5 = ?$
 $7 + 6 = ?$ $13 - 7 = ?$
 $6 + 7 = ?$ $13 - 6 = ?$

2. Charles had 2 hens, and Ralph had 12; each bought 1 more. Charles then had —, and Ralph had —.

3. If I have 1 cent, and Fred has 11 cents, and each of us earns 2 cents more, I shall have — cents, and Fred will have — cents.



1 and 2 are —; 11 and 2 are —.

4. How many stripes has the American flag? 7 of the stripes are red, and the rest are white. How many are white?



5. Tell at sight what number put with each of the following numbers will make 13.

1; 3; 6; 8; 5; 9; 7; 2; 11; 4; 10; 12.

6. Make 13 marks by 2's; by 3's; etc., as you may need to help you fill out the following :

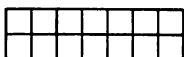
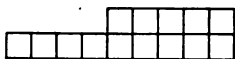
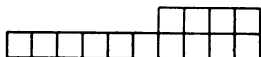
7.

- 13 = — 2's and —.
 13 = — 3's and —.
 13 = — 4's and —.
 13 = — 5's and —.
 13 = — 6's and —.

8.

- 2 in 13, — times and — over.
 3 in 13, — times and — over.
 4 in 13, — times and — over.
 5 in 13, — times and — over.
 6 in 13, — times and — over.

The Number Fourteen. 14.



1. $10 + 4 = ?$ $14 - 4 = ?$
 $4 + 10 = ?$ $14 - 10 = ?$
 $9 + 5 = ?$ $14 - 5 = ?$
 $5 + 9 = ?$ $14 - 9 = ?$
 $8 + 6 = ?$ $14 - 8 = ?$
 $6 + 8 = ?$ $14 - 6 = ?$
 $7 + 7 = ?$ $14 - 7 = ?$
Two 7's = ? $\frac{1}{2}$ of 14 = ?

2. Maude had 3 paper dolls, and Grace had 13. After each had 1 more given her, Maude had —, and Grace had —. 3 and 1 are —. 13 and 1 are —.

3. Maude gave 2 of her 4 dolls to Dora, and Grace gave 2 to Ethel. How many did each have left?

4 less 1 is —. 14 less 1 is —. 14 less 11 is —.
4 less 3 is —. 14 less 3 is —. 14 less 13 is —.

4. Tell at sight what number put with each of the following numbers will make 14:

1; 3; 6; 7; 2; 4; 8; 5; 10; 12; 9; 11; 13.

5. Separate 14 blocks into 2's; separate them into 7's.

In 14 there are — 2's; there are — 7's.

6. Make 14 marks by 3's; by 4's; etc., as you may need to help you fill out the following.

7.

14 = — 3's and —.

14 = — 4's and —.

14 = — 5's and —.

14 = — 6's and —.

8.

3 in 14 — times and — over.

4 in 14 — times and — over.

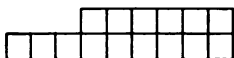
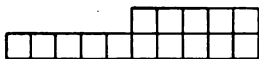
5 in 14 — times and — over.

6 in 14 — times and — over.

Give the sums of the following:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>
9.	5	7	5	8	4	8	6	7	9	5	7	9
	<u>9</u>	<u>6</u>	<u>7</u>	<u>4</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>3</u>	<u>5</u>	<u>8</u>	<u>7</u>	<u>4</u>

The Number Fifteen. 15.

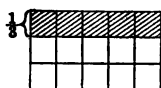


1. $10 + ? = 15$ $15 - 5 = ?$
 $5 + ? = 15$ $15 - ? = 5$
 $9 + ? = 15$ $15 - ? = 9$
 $5 + ? = 15$ $? - 9 = 6$
 $8 + 7 = ?$ $15 - ? = 7$
 $? + 8 = 15$ $15 - ? = 8$

2. How many are $2 + 3$? $12 + 3$? $1 + 4$? $11 + 4$?

3. Tell at sight what number put with each of the following will make 15 :

1; 9; 5; 6; 11; 2; 7; 4; 8; 3; 10; 12; 14; 13.



4. $\frac{1}{3}$ of 15 squares is — squares.
 $\frac{2}{3}$ of 15 squares are — squares.

5. Show by blocks, or a picture of squares, $\frac{1}{5}$ of 15; $\frac{2}{5}$ of 15; $\frac{3}{5}$ of 15; $\frac{4}{5}$ of 15.

6. Separate 15 cents into equal parts of 3 cents each.

In 15 there are — 3's.

Separating a number into equal parts is **dividing**.
 15 divided by 3 equals 5. This may be written $15 \div 3 = 5$. Read $14 \div 2 = 7$.

7. How many are $15 \div 5$? $14 \div 7$? $14 \div 2$? $12 \div 2$?

8. Make 15 marks by 2's, by 4's, etc., as you may need to help you fill out the following :

9. $15 = \text{— } 2\text{'s and —.}$ 10. $15 \div 2 = \text{— and — over.}$
 $15 = \text{— } 4\text{'s and —.}$ $15 \div 4 = \text{— and — over.}$
 $15 = \text{— } 6\text{'s and —.}$ $15 \div 6 = \text{— and — over.}$
 $15 = \text{— } 7\text{'s and —.}$ $15 \div 7 = \text{— and — over.}$

Give the sums of the following :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>
11.	8	7	3	4	5	9	8	5	4	2	11	6
	<u>3</u>	<u>6</u>	<u>12</u>	<u>11</u>	<u>7</u>	<u>4</u>	<u>7</u>	<u>8</u>	<u>8</u>	<u>9</u>	<u>3</u>	<u>8</u>

1. Clara spent a fortnight and 1 day with her aunt. A fortnight and 1 day is — days.

If she had spent 1 day less than a fortnight, she would have spent — days.

2. John has a dime, and Fred has a nickel and 8 cents. Fred has — more cents than John.

3. If I have 15 cents, and give $\frac{1}{3}$ of my money to John, I shall give him — cents, and I shall have — cents left.

4. How many feet make a yard? How many yards long is a walk that is 15 feet long?

5. George bought a pencil for 4 cents, and some paper for 8 cents. He gave the storekeeper a dime and a nickel. How many cents should he receive back.

6. If it takes half a lemon for each glass of lemonade, how many lemons will be needed for 2 glasses? for 14 glasses? for 15 glasses?

7. How many glasses, each holding half a pint, can be filled with 1 pint of jelly? with 1 quart? with 5 quarts?

8. Reuben has a flower bed 7 feet long and 2 feet wide. Draw a plan of the flower bed, and show how many square feet it will contain.

9. Oscar's flower bed is 5 feet long and 3 feet wide. How many square feet are there in his flower bed?

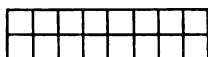
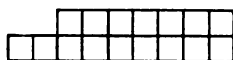
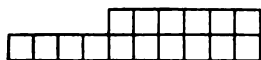
10. If I find a dozen eggs and then find enough to make 15 eggs, I shall find — more eggs.

11. If Ellen has 15 eggs, and uses $\frac{1}{3}$ of them for a custard pie, she will use — eggs.

12. If, in making custards, Ellen allows 5 eggs to a quart of milk, how many eggs does she allow for 3 quarts of milk?

13. At 12 cents a dozen, how much will 15 eggs cost?

The Number Sixteen. 16.



1. $10 + 6 = ?$ $16 - ? = 10$

$6 + 10 = ?$ $16 - ? = 6$

$9 + 7 = ?$ $? - 7 = 9$

$7 + 9 = ?$ $16 - 9 = ?$

$8 + 8 = ?$ $\frac{1}{2}$ of $16 = ?$

$8 \times 2 = ?$ $16 \div 8 = ?$

2. How many are $1 + 5$? $11 + 5$? $3 + 3$? $13 + 3$?

3. How many are $6 - 4$? $16 - 4$? $6 - 2$? $16 - 2$?

4. Tell rapidly all the pairs of numbers that make 16, thus: "15 and 1;" "14 and 2," etc.

5. Arrange 16 dots by 4's. In 1 row there are — dots. In 2 rows there are — dots. In 3 rows there are — dots; in 4 rows — dots.

6. How many are 2 times 4? 3 times 4? 4×4 ? 8×2 ? 2×8 ?

7. How many are 16 divided by 2? $16 \div 4$? $16 \div 8$?

8.

9.

$16 =$ — times 3 and — over. $16 \div 3 =$ — and — over.

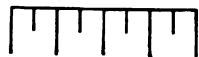
$16 =$ — times 5 and — over. $16 \div 5 =$ — and — over.

$16 =$ — times 7 and — over. $16 \div 7 =$ — and — over.

10. Fold a strip of paper into 8 equal parts.

One of these parts is one eighth, written $\frac{1}{8}$.

How many parts must you take away to leave $\frac{5}{8}$? $\frac{3}{8}$? $\frac{7}{8}$?



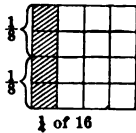
11. $\frac{1}{4}$ of an inch equals — eighths.

$\frac{2}{4} =$ — eighths. $\frac{1}{2}$ of $\frac{1}{4} =$ —.

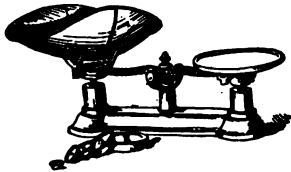
How many eighths are there in 1? in 2? in $\frac{1}{2}$? in $\frac{1}{4}$?

12. Give at sight the missing numbers:

6	?	7	?	8	?	5	9	7	?	?	5
?	8	?	9	?	9	?	?	?	8	7	?
<u>13</u>	<u>16</u>	<u>12</u>	<u>16</u>	<u>14</u>	<u>15</u>	<u>11</u>	<u>14</u>	<u>16</u>	<u>15</u>	<u>13</u>	<u>13</u>



1. $\frac{1}{4}$ of 16 = ? $\frac{3}{4}$ of 16 = ? $\frac{3}{4}$ of 16 = ?
 $\frac{1}{8}$ of 16 = ? $\frac{3}{8}$ of 16 = ? $\frac{4}{8}$ of 16 = ?
2. Show by blocks or by a picture of squares $\frac{3}{8}$ of 16. $\frac{7}{8}$ of 16.



3. Here is a pair of scales with some weights to weigh with. The largest is a 1-pound weight, the smallest is a 1-ounce weight.

16 ounces make 1 pound.

4.

- 1 pound = — ounces.
 $\frac{1}{2}$ pound = — ounces.
 $\frac{1}{4}$ pound = — ounces.
 $\frac{3}{4}$ pound = — ounces.

5.

- $\frac{1}{8}$ pound = — ounces.
 $\frac{3}{8}$ pound = — ounces.
 $\frac{5}{8}$ pound = — ounces.
 $\frac{7}{8}$ pound = — ounces.

6. When beefsteak costs 16 cents a pound, $\frac{1}{2}$ pound will cost $\frac{1}{2}$ of 16 cents, or — cents; $\frac{1}{4}$ of a pound will cost $\frac{1}{4}$ of 16 cents, or — cents; $\frac{3}{4}$ of a pound will cost — times — cents, or — cents.

7. If a pint of water weighs a pound, what will a gill of water weigh? A gill is $\frac{1}{4}$ of a pint. A gill weighs $\frac{1}{4}$ of a pound or — ounces. Answer — ounces.

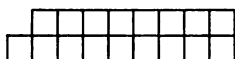
8. In a gallon there are 4 quarts. A two-gallon measure holds — quarts. A three-gallon measure holds — quarts. A four-gallon measure holds — quarts.

9. When milk is 16 cents a gallon, 1 quart will cost $\frac{1}{4}$ of 16 cents, or — cents. 2 quarts will cost — cents, and 3 quarts will cost — cents.

10. How many gallons and how many quarts over are there in 9 quarts? in 10 quarts? in 14 quarts?

11. In 16 gills there are how many pints? 4 gills make a pint; in 16 gills there are as many pints as there are 4's in 16, or — pints.

The Number Seventeen. 17.



$$\begin{array}{ll}
 1. \quad 10 + 7 = ? & 17 - 10 = ? \\
 & 7 + 10 = ? & 17 - 7 = ? \\
 & 9 + 8 = ? & 17 - 9 = ? \\
 & 8 + 9 = ? & 17 - 8 = ?
 \end{array}$$

2. How many are $1 + 6$? $11 + 6$? $7 - 2$? $17 - 2$?
3. How many are $7 - 3$? $17 - 3$? $7 - 5$? $17 - 5$?
4. Tell at sight what number put with each of the following numbers will make 17.

14; 16; 8; 5; 7; 2; 6; 14; 2; 15; 9; 4; 12; 3.

5.

$$4 \times 4 \text{ and } \text{---} = 17.$$

$$5 \times 3 \text{ and } \text{---} = 17.$$

$$8 \times 2 \text{ and } \text{---} = 17.$$

$$3 \times 5 \text{ and } \text{---} = 17.$$

$$6 \times 2 \text{ and } \text{---} = 17.$$

6.

$$17 \div 2 = \text{---} \text{ and } \text{---} \text{ over.}$$

$$17 \div 3 = \text{---} \text{ and } \text{---} \text{ over.}$$

$$17 \div 4 = \text{---} \text{ and } \text{---} \text{ over.}$$

$$17 \div 6 = \text{---} \text{ and } \text{---} \text{ over.}$$

$$17 \div 7 = \text{---} \text{ and } \text{---} \text{ over.}$$

7. Two weeks and — days are 17 days.
8. A dime, a nickel, and — cents, are 17 cents.
9. With 17 cents I can pay for 2 five-cent car rides, and buy 2 two-cent postage stamps, and have — cents left.

10. With 17 cents I can buy — papers of pins at 6 cents a paper, and have — cents left.

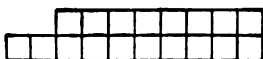
11. With 17 splints I can make a hexagon, a pentagon, and a square, and have — splints left.

12. Tell something about buying fruit with 17 cents.

Add the following :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>
13.	3	5	8	2	6	3	2	7	9	6	4	6
	2	3	0	6	3	9	5	3	6	2	0	0
	2	3	2	5	0	4	2	4	0	5	2	6
	<u>5</u>	<u>2</u>	<u>5</u>	<u>4</u>	<u>4</u>	<u>1</u>	<u>5</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>7</u>	<u>5</u>

The Number Eighteen. 18.

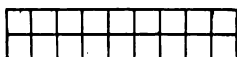


1. $10 + 8 = ?$ $18 - 10 = ?$

$8 + 10 = ?$ $18 - 8 = ?$

$9 + 9 = ?$ $\frac{1}{2}$ of 18 = ?

Two 9's = ? $18 \div 2 = ?$



2. Tell at sight what number must be put with each of the following numbers to make 18 :

2; 5; 8; 13; 16; 3; 6; 11; 15; 4; 7; 12; 14.

3. In 3 rows of dots, 6 in a row, there are — dots. There are — 6's in 18. 3 times — are 18.

4.

5.

6.

$18 = _ \times 3$. $18 = 4 \times _$ and 2 more. Divide 18 by 3.

$18 = _ \times 2$. $18 = 8 \times _$ and 2 more. Divide 18 by 6.

$18 = _ \times 6$. $18 = 7 \times _$ and 4 more. Divide 18 by 9.

$18 = _ \times 9$. $18 = 5 \times _$ and 3 more. Divide 18 by 2.

7. $\frac{1}{3}$ of 18 = ? $\frac{2}{3}$ of 18 = ?



8. Show by blocks, or a picture of squares, $\frac{1}{6}$ of 18; $\frac{2}{6}$ of 18; $\frac{5}{6}$ of 18. $\frac{1}{3}$ = how many sixths?

The Number Nineteen. 19.



9. $10 + 9 = ?$ $19 - 9 = ?$

$9 + 10 = ?$ $19 - 10 = ?$

10.

11.

$19 \div 2 = _$ and — over. $19 \div 6 = _$ and — over.

$19 \div 3 = _$ and — over. $19 \div 7 = _$ and — over.

$19 \div 4 = _$ and — over. $19 \div 8 = _$ and — over.

$19 \div 5 = _$ and — over. $19 \div 9 = _$ and — over.

12. To each of the numbers 2, 4, 5, 3, 6, 8, 7, 9,

Add 1; add 2; add 3; 4; 5; 6; 7; 8; 9.

Add these over and over till you can add them rapidly at sight.

Add at sight :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>
1.	6	7	8	9	7	8	9	9	7	9	9	2
	<u>7</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>6</u>	<u>6</u>	<u>9</u>	<u>7</u>	<u>9</u>
2.	8	9	8	6	8	7	6	8	6	7	9	5
	<u>7</u>	<u>4</u>	<u>9</u>	<u>5</u>	<u>5</u>	<u>4</u>	<u>8</u>	<u>3</u>	<u>6</u>	<u>9</u>	<u>6</u>	<u>9</u>

Subtract at sight :

	<i>m</i>	<i>n</i>	<i>o</i>	<i>p</i>	<i>q</i>	<i>r</i>	<i>s</i>	<i>t</i>	<i>u</i>
3.	18	15	17	14	16	12	11	13	10
	<u>8</u>	<u>6</u>	<u>9</u>	<u>6</u>	<u>9</u>	<u>8</u>	<u>5</u>	<u>7</u>	<u>3</u>

4. What is $\frac{1}{2}$ of 8? of 12? of 16? of 14? of 18? of 10?
5. What is $\frac{1}{3}$ of 6? of 15? of 12? of 18? of 9?
6. What is $\frac{1}{4}$ of 4? of 16? of 12? of 8?
7. What is $\frac{1}{5}$ of 5? of 15? of 10?
8. What is $\frac{1}{6}$ of 18? of 6? of 12?
9. What part of 18 is 6? is 9? is 3?
10. 7 geese and 5 ducks are — fowls.
8 roses and 9 pinks are — flowers.
5 spiders and 8 butterflies are — insects.
8 perch and 7 pickerel are — fishes.
9 robins and 7 larks are — birds.
12 lions and 1 tiger are — animals.
11. In one cage there are 13 monkeys, in another are 6 guinea pigs. There are — animals in both cages.
There are — more monkeys than guinea pigs.
12. From a brood of 17 chickens, half a dozen were taken by a fox, and half a dozen were eaten by the family. — chickens were left.
13. $\frac{1}{2}$ dozen is —, $\frac{1}{4}$ dozen is —; $\frac{1}{2}$ dozen and $\frac{1}{4}$ dozen are —. $\frac{1}{2}$ of 8 is —, $\frac{1}{4}$ of 8 is —, $\frac{1}{2}$ of 8 and $\frac{1}{4}$ of 8 are —.
14. In 18 months there are — more months than in a year.

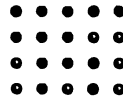
The Number Twenty. 20.



2 tens = 10 twos.

1. In 20 there are — tens ; there are — twos.
2. How many 2's can be subtracted from 20 ? How many 10's can be subtracted from 20 ?
3. How many shoes will be required to shoe 5 horses ? 10 boys ?

4. In each row of dots there are — dots.
In 4 rows there are 4 times — dots, or — dots.



5. In each column of dots there are — dots. In 5 columns of dots there are 5 times — dots, or — dots.

6. How many 5's are there in 20 ? How many 4's ?

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
7. From	10	20	10	20	10	20	10	20	10	20
take	<u>1</u>	<u>1</u>	<u>9</u>	<u>9</u>	<u>2</u>	<u>2</u>	<u>8</u>	<u>8</u>	<u>3</u>	<u>3</u>

8. From	10	20	10	20	10	20	10	20	20	10
take	<u>7</u>	<u>7</u>	<u>4</u>	<u>4</u>	<u>6</u>	<u>6</u>	<u>5</u>	<u>5</u>	<u>10</u>	<u>10</u>

9. How many more are 20 than 19 ? In the same way compare 20 with 16 ; 15 ; 11 ; 18 ; 12 ; 14 ; 17 ; 13.
10. How many are $4 + 7 - 6 + 9 - 8 + 4 - 5 + 8 - 7 + 9$?
Read and fill out:

- | | |
|---------------------------|-------------------------------------|
| 11. $3 \times 6 + ? = 20$ | 12. $20 + 3 = \text{—}$ and — over. |
| $6 \times 3 + ? = 20$ | $20 + 6 = \text{—}$ and — over. |
| $7 \times 2 + ? = 20$ | $20 + 7 = \text{—}$ and — over. |
| $9 \times 2 + ? = 20$ | $20 + 8 = \text{—}$ and — over. |
| $8 \times 2 + ? = 20$ | $20 + 9 = \text{—}$ and — over. |

1. Robert had in his pocket a half-dime, and he earned 3 half-dimes more. He then had — dimes, or — cents.

2. In 20 cents there are — dimes.

In 20 inches there is — foot and — inches.

In 20 feet there are — yards and — feet.

In 20 quarts there are — gallons.

In 20 days there are — weeks and — days.

In 20 ounces there is — pound and — ounces.

In 20 months there is — year and — months.

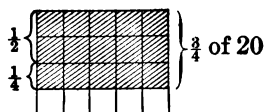
In 20 gills there are — pints.

In 20 pints there are — quarts.

3. $\frac{1}{2}$ of 20 = ?

$\frac{1}{4}$ of 20 = ?

$\frac{3}{4}$ of 20 = ?



4. Show by blocks or by a picture of squares :

$\frac{1}{5}$ of 20 ; $\frac{2}{5}$ of 20 ; $\frac{3}{5}$ of 20 ; $\frac{4}{5}$ of 20 .

$\frac{1}{5}$ of 20 = ? $\frac{2}{5}$ of 20 = ? $\frac{3}{5}$ of 20 = ? $\frac{4}{5}$ of 20 = ?

5. In 4 inches there are how many half-inches ? In 1 inch there are — half-inches ; in 4 inches there are 4 times — half-inches, or — half-inches.

6. In $4\frac{1}{2}$ inches there are how many half-inches ? In 4 inches there are — half-inches. 8 half-inches and 1 half-inch are — half-inches.

7. In 10 apples there are — half-apples.

8. In 6 apples there are — thirds of an apple.

9. In 5 there are — fourths.

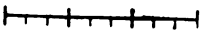
10. In 3 there are — sixths.

11. In $3\frac{1}{4}$ there are — fourths.

12. In $4\frac{1}{5}$ there are — fifths.

13. In $2\frac{1}{8}$ there are — eighths.

14. In $3\frac{2}{5}$ there are — fifths.

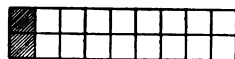
1. Here is 1 inch divided into  thirds, and each third is divided into three equal parts. Into how many equal parts is the inch divided? What should one of the smallest parts be called? 1 ninth is written $\frac{1}{9}$.

2. $\frac{1}{9}$ equals — ninths. $\frac{2}{9}$ equals — ninths.

In 1 inch there are — ninths; in 2 inches there are — ninths.

3. $\frac{1}{9}$ of 9 squares is — square.

$\frac{1}{9}$ of 18 squares is — squares.



4. Stanley's father gave him 15 $\frac{1}{9}$ of 18 = cents; his mother gave him $\frac{1}{9}$ as many. Stanley then had — cents.

5. There are 19 windows in the house, and all but 8 have screens. How many windows have screens?

6. One morning Harry fed 9 sparrows, 3 robins, and 8 doves. How many birds did he feed in all?

7. In a room there are 2 windows of 2 sashes each, and 4 panes to a sash. How many panes are there in all?

8. What must you pay for a gallon of vinegar at 5 cents a quart?

9. How many lemons are there in 1 dozen, 1 half-dozen, and 1 lemon more?

10. If a strip of paper is 6 inches long and 3 inches wide, how many square inches does it contain?

11. If the cover of a book contains 20 square inches, and it is 5 inches long, how wide is it?

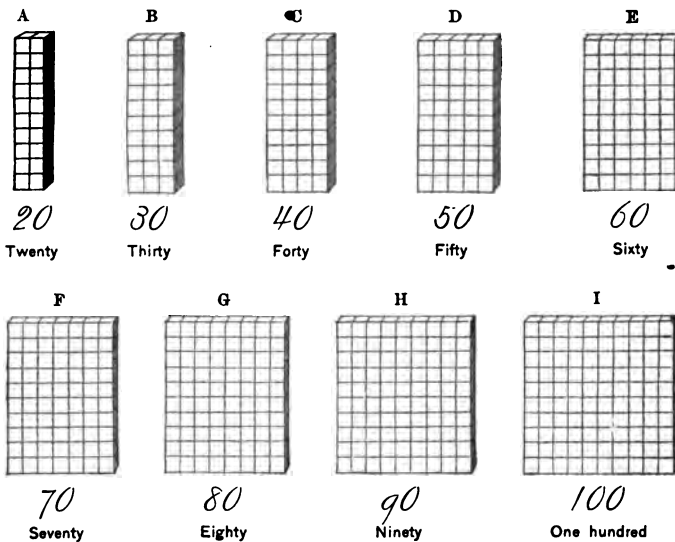
12. What part of 20 is 10? is 5? is 4?

13. If 20 shells were divided equally among 4 girls, how many would each have?

14. If 20 inches of ribbon were put into 5 loops, how many inches were put into each loop?

LESSON 44.

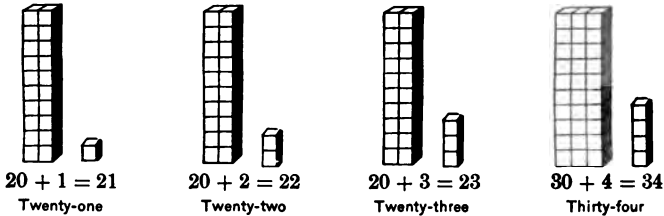
Numbers made up of Tens.



Exercises.

1. In the figure marked A there are — tens of blocks, written 20.
2. How many tens of blocks are there in B? in C? in D? in E? in F? in G? in H? in I?
3. The name given to 2 tens is —; to 3 tens is —; to 4 tens is —; to 5 tens is —; to 6 tens is —; to 7 tens is —; to 8 tens is —; to 9 tens is —; to 10 tens is —.
4. Write twenty; thirty; forty; fifty; sixty.
5. Write seventy; eighty; ninety; one hundred.
6. Count by 10's from 10 to 100; thus, "ten; twenty; thirty;" etc.
7. Count by 10's from 100 down to nothing.

Numbers from Twenty to One Hundred.



1. Count by ones from twenty to thirty. From thirty to forty.

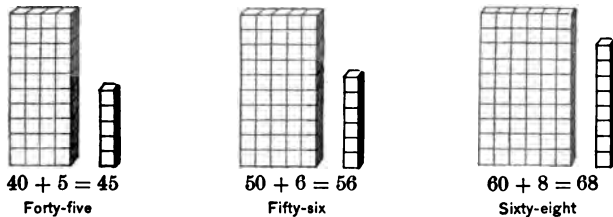
2. Show by blocks or by a drawing, the numbers from twenty-four to twenty-nine.

Ones are called **units**.

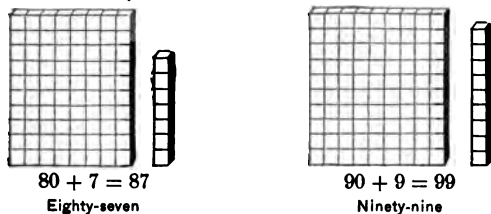
3. Twenty-three = 2 tens and — units.

Twenty-five = — tens and — units.

Thirty-six = — tens and — units.



4. Count by 1's from 30 to 40. From 40 to 60. From 80 to 100.



5. Count by 1's from 30 to 20. From 50 to 30. From 80 to 60.

Read and fill out :

1.	2.	3.
20 + 3 = 23	2 tens + 4 units = 24	25 = 2 tens + 5 units
30 + 2 = —	2 tens + 9 units = —	36 = — tens + — units
40 + 8 = —	4 tens + 6 units = —	49 = — tens + — units
50 + 6 = —	5 tens + 8 units = —	56 = — tens + — units
80 + 4 = —	7 tens + 1 unit = —	64 = — tens + — units
90 + 9 = —	8 tens + 3 units = —	87 = — tens + — units
90 + 10 = —	9 tens + 4 units = —	98 = — tens + — units

4.	5.	6.	7.
3 + 2 = ?	5 + 3 = ?	3 + 4 = ?	2 + 5 = ?
43 + 2 = ?	25 + 3 = ?	33 + 4 = ?	32 + 5 = ?
4 + 2 = ?	4 + 3 = ?	1 + 4 = ?	3 + 5 = ?
64 + 2 = ?	44 + 3 = ?	21 + 4 = ?	63 + 5 = ?
7 + 2 = ?	6 + 3 = ?	5 + 4 = ?	4 + 5 = ?
77 + 2 = ?	96 + 3 = ?	55 + 4 = ?	44 + 5 = ?

8.	9.	10.	11.
3 + 6 = ?	1 + 7 = ?	1 + 8 = ?	25 + 2 = ?
13 + 6 = ?	21 + 7 = ?	31 + 8 = ?	42 + 3 = ?
1 + 6 = ?	2 + 7 = ?	71 + 8 = ?	44 + 6 = ?
51 + 6 = ?	52 + 7 = ?	40 + 8 = ?	32 + 7 = ?
2 + 6 = ?	82 + 7 = ?	90 + 8 = ?	72 + 8 = ?
72 + 6 = ?	92 + 7 = ?	80 + 9 = ?	81 + 9 = ?

12.	13.	14.	15.
12 - 1 = ?	8 - 2 = ?	16 - 3 = ?	19 - 4 = ?
22 - 1 = ?	18 - 2 = ?	26 - 3 = ?	49 - 4 = ?
19 - 1 = ?	25 - 2 = ?	48 - 3 = ?	87 - 4 = ?
39 - 1 = ?	35 - 2 = ?	98 - 3 = ?	27 - 4 = ?

- | | |
|----------------------------|----------------------------|
| 16. 40 - 5 - 5 - 5 - 5 = ? | 19. 68 - 5 - 5 - 5 - 5 = ? |
| 17. 5 + 10 + 10 + 10 = ? | 20. 7 + 10 + 10 + 10 = ? |
| 18. 94 - 10 - 10 - 10 = ? | 21. 86 - 10 - 10 - 10 = ? |

LESSON 47.

58

1.	2.	3.	4.
16-5=?	19-6=?	28-7=?	59-8=?
46-5=?	49-6=?	98-7=?	28-3=?
87-5=?	37-6=?	39-7=?	37-5=?
99-5=?	48-6=?	59-7=?	59-9=?
5. 60-9-1-6-4-7-3-2-8-5-5-4-6=?			

Add the following :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
6.	20 <u>40</u>	20 <u>20</u>	40 <u>50</u>	50 <u>20</u>	30 <u>30</u>	80 <u>10</u>	30 <u>50</u>
7.	30 <u>40</u>	50 <u>10</u>	70 <u>20</u>	40 <u>40</u>	50 <u>40</u>	30 <u>60</u>	60 <u>20</u>
8.	45 <u>3</u>	32 <u>5</u>	51 <u>6</u>	75 <u>4</u>	84 <u>4</u>	63 <u>6</u>	92 <u>7</u>

In the following add first the units, then the tens :

9.	45 <u>43</u>	32 <u>25</u>	51 <u>46</u>	75 <u>24</u>	84 <u>14</u>	63 <u>26</u>	72 <u>17</u>
10.	36 <u>30</u>	29 <u>70</u>	54 <u>25</u>	40 <u>52</u>	61 <u>17</u>	63 <u>35</u>	20 <u>59</u>
11.	24 11 22 <u>32</u>	23 21 10 <u>44</u>	12 12 42 <u>33</u>	22 21 30 <u>26</u>	21 20 35 <u>13</u>	33 30 13 <u>22</u>	12 23 32 <u>22</u>

Subtract the following, subtracting first the units, then the tens :

12.	25 <u>13</u>	36 <u>15</u>	44 <u>43</u>	69 <u>37</u>	84 <u>53</u>	75 <u>50</u>	97 <u>24</u>
13.	38 <u>25</u>	25 <u>12</u>	57 <u>12</u>	69 <u>45</u>	87 <u>43</u>	96 <u>46</u>	89 <u>36</u>

1. Ellen had 50 cents and John had 30 cents. If Ellen should give John 10 cents, she would have — cents left. John would have — cents.

2. Dick's father rode 40 miles one day and 50 miles the next. He rode — miles in both days. For 70 miles the traveling was smooth, and the rest was very rough. — miles were rough.

3. There were 60 sheep in one flock and 40 in another. There were — sheep in both flocks.

4. What is 1 half of 6 minutes? $\frac{1}{2}$ of 60 minutes?

5. 60 minutes make an hour. If your noon recess is $1\frac{1}{2}$ hours long, how many minutes long is it?

6. If it takes 10 minutes to go home, 30 minutes to eat your dinner, and 10 minutes to return, how many minutes of the $1\frac{1}{2}$ hours remain?

7. If your recitation room is 30 feet long and 20 feet wide, how many feet is it around the room?

8. How many are $10 + 30 + 40 + 20 - 50$?

9. How many are $20 + 70 - 30 - 10 + 5$?

10. How many are $50 + 20 + 20 - 60 - 10$?

11. 2 dimes + 3 dimes = — dimes = — cents.

12. 5 dimes + 4 dimes = — dimes = — cents.

13. 10 dimes - 7 dimes = — dimes = — cents.

14. 10 dimes - 3 dimes = — dimes = — cents.

15. 7 dimes + 2 dimes + 5 cents = — cents.

16. 4 dimes + 3 dimes + 9 cents = — cents.

100 cents (¢) make 1 dollar (\$).

¢ stands for cents, \$ stands for dollars.

17. $20¢ + 10¢ + 30¢ = \text{—}¢$. 19. $80¢ - 50¢ - 20¢ = \text{—}¢$.

18. $30¢ + 20¢ + 40¢ = \text{—}¢$. 20. $\$1 - 50¢ - 10¢ = \text{—}¢$.

21. Maria had 2 half dollars. She spent one of them for a hat, and 30 cents of the other half for gloves. How many cents had she left?

Add the following :

	<i>a</i>	<i>b</i>	-	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>
1.	2	2		2	2	2	3	3	3	3
	<u>9</u>	<u>19</u>		<u>29</u>	<u>39</u>	<u>59</u>	<u>9</u>	<u>19</u>	<u>39</u>	<u>69</u>
2.	3	3		3	3	3	4	4	4	4
	<u>8</u>	<u>28</u>		<u>18</u>	<u>48</u>	<u>68</u>	<u>9</u>	<u>29</u>	<u>49</u>	<u>79</u>

Subtract the following :

3.	11	21	41	61	71	31	51	81	91
	<u>2</u>	<u>2</u>	<u>2</u>	<u>2</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>
4.	12	22	52	42	13	23	53	73	63
	<u>3</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>

5. Charles is 9 years old, and his father is 49. In 3 years more Charles will be — years old, and his father will be — years old.

6. Charles had 8 cents, and James had 38 cents, when their father gave to each 3 cents more. Then Charles had — cents, and James had — cents.

7. Charles spent 2 of his 11 cents, and James 2 of his 41 cents ; then Charles had — cents, and James had — cents.

8. How many splints are 19 splints and 2 splints ?

9. How many hens are 39 hens and 3 hens ?

10. How many days are 18 days and 3 days ?

11. How many sheep are 31 sheep less 3 sheep ?
91-3?

12. Count by 2's from 20 to 40; from 40 to 20.

13. Count by 2's from 51 to 71; from 71 to 51.

14. Count by 3's from 30 to 60; from 31 to 61; from 32 to 62.

15. Count back by 3's from 60 to 30; from 61 to 31; from 62 to 32.

1. How many are $8+4$? $18+4$? $28+4$? $48+4$?
2. What is the unit's figure of each answer to the above?
3. How many are $7+4$? $17+4$? $57+4$? $87+4$?
4. What is the unit's figure of each answer to the above?
5. How many are $11-4$? $21-4$? $41-4$? $71-4$?
6. How many are $12-4$? $42-4$? $32-4$? $82-4$?
7. What is the unit's figure of the remainder, when 4 is taken from a number whose unit's figure is 1? 2?
8. $9+5$? $19+5$? $39+5$? $49+5$? $89+5$?
9. $7+5$? $17+5$? $37+5$? $57+5$? $67+5$?
10. $8+5$? $38+5$? $68+5$? $98+5$? $58+5$?
11. $6+5$? $16+5$? $36+5$? $66+5$? $86+5$?
12. What is the unit's figure of the sum, when 5 is added to a number whose unit's figure is 9? 7? 8? 6?
13. $14-5$? $24-5$? $64-5$? $54-5$? $84-5$?
14. $12-5$? $32-5$? $72-5$? $52-5$? $92-5$?
15. $13-5$? $23-5$? $53-5$? $43-5$? $73-5$?
16. $11-5$? $31-5$? $41-5$? $61-5$? $81-5$?
17. What is the unit's figure of the remainder, when 5 is taken from a number whose unit's figure is 4? 2? 3? 1?
18. Add by 4's from 20 to 40; from 21 to 41.
19. Subtract by 4's from 40 to 20; from 41 to 21.
20. Add by 5's from 20 to 40; from 21 to 41; from 22 to 42; from 23 to 43; from 24 to 44.
21. Subtract by 5's from 40 to 20; from 41 to 21; from 42 to 22; from 43 to 23; from 44 to 24.
22. Alva spent 5 cents of his money for firecrackers and then had 67 cents left. How many cents did he have at first?
23. After May 5th, how many days of May are left?

LESSON 51.**57**

1. $9+6?$ $39+6?$ $59+6?$ $8+6?$ $38+6?$
2. $7+6?$ $17+6?$ $37+6?$ $6+6?$ $26+6?$
3. $5+6?$ $25+6?$ $45+6?$ $4+6?$ $34+6?$

4. What is the unit's figure of the sum when 6 is added to a number whose unit's figure is 9? 8? 7? 5? 6? 4?

5. $15-6?$ $25-6?$ $45-6?$ $13-6?$ $33-6?$
6. $12-6?$ $32-6?$ $52-6?$ $11-6?$ $21-6?$
7. $14-6?$ $44-6?$ $64-6?$ $10-6?$ $50-6?$

8. What is the unit's figure of the remainder when 6 is taken from a number whose unit's figure is 5? 3? 2? 1? 4? 0?

9. $9+7?$ $19+7?$ $49+7?$ $6+7?$ $26+7?$
10. $4+7?$ $24+7?$ $54+7?$ $8+7?$ $28+7?$
11. $5+7?$ $35+7?$ $65+7?$ $7+7?$ $37+7?$

12. What is the unit's figure of the sum when 7 is added to a number whose unit's figure is 9? 6? 4? 8? 5? 7?

13. $16-7?$ $26-7?$ $46-7?$ $13-7?$ $33-7?$
14. $11-7?$ $31-7?$ $51-7?$ $15-7?$ $25-7?$
15. $14-7?$ $44-7?$ $84-7?$ $12-7?$ $32-7?$

16. What is the unit's figure of the remainder when 7 is taken from a number whose unit's figure is 6? 3? 1? 5? 4? 2?

17. Add by 6's from 10 to 40; from 11 to 41.

18. Add by 7's from 1 to 71.

19. Subtract by 6's from 40 to 10; from 41 to 11.

20. Subtract by 7's from 71 to 1.

21. Ralph has 34 English walnuts. How many will remain after 6 are eaten? After 7 are eaten?

22. Mary found 39 nuts, then 7, then 6, after which she ate 5. How many had she left?

1. $9+8?$ $29+8?$ $69+8?$ $8+8?$ $18+8?$
2. $6+8?$ $16+8?$ $46+8?$ $4+8?$ $44+8?$
3. $3+8?$ $13+8?$ $53+8?$ $5+8?$ $65+8?$
4. $7+8?$ $27+8?$ $77+8?$ $2+8?$ $42+8?$

5. What is the unit's figure of the sum when 8 is added to a number whose unit's figure is 9? 7? 4? 2? 8? 5? 6? 3?

6. $17-8?$ $57-8?$ $37-8?$ $16-8?$ $36-8?$
7. $14-8?$ $24-8?$ $54-8?$ $12-8?$ $52-8?$
8. $11-8?$ $31-8?$ $51-8?$ $13-8?$ $63-8?$
9. $15-8?$ $47-8?$ $77-8?$ $10-8?$ $40-8?$

10. What is the unit's figure of the remainder when 8 is taken from a number whose unit's figure is 5? 7? 4? 1? 6? 2? 0? 3?

11. $9+9?$ $19+9?$ $8+9?$ $68+9?$ $4+9?$
12. $3+9?$ $23+9?$ $6+9?$ $46+9?$ $7+9?$
13. $5+9?$ $35+9?$ $2+9?$ $82+9?$ $71+9?$

14. What is the unit's figure of the sum when 9 is added to a number whose unit's figure is 9? 3? 5? 8? 6? 2? 4? 7? 1?

15. $18-9?$ $38-9?$ $47-9?$ $77-9?$ $23-9?$
16. $12-9?$ $32-9?$ $14-9?$ $44-9?$ $16-9?$
17. $15-9?$ $55-9?$ $11-9?$ $61-9?$ $10-9?$

18. What is the unit's figure of the remainder when 9 is taken from a number whose unit's figure is 8? 2? 3? 7? 4? 6? 0? 1? 5?

19. Add by 8's from 10 to 50; from 11 to 51.
20. Add by 9's from 10 to 55; from 15 to 60.
21. Subtract by 8's from 50 to 10; from 51 to 11.
22. Subtract by 9's from 55 to 10; from 60 to 15.

LESSON 53.

59

Drill Table in Addition and Subtraction.

<i>a</i>	1	31	51	11	41	21	71	61	81	91
<i>b</i>	2	22	62	82	12	52	72	32	92	42
<i>c</i>	3	33	13	23	63	93	43	83	53	73
<i>d</i>	4	44	24	54	34	14	74	64	84	94
<i>e</i>	5	25	65	15	75	35	85	45	95	55
<i>f</i>	6	36	56	46	16	76	26	66	86	96
<i>g</i>	7	47	67	27	97	37	57	17	87	77
<i>h</i>	8	58	28	48	68	18	78	38	98	88
<i>i</i>	9	29	69	39	79	49	89	59	19	99
<i>j</i>	10	20	80	50	60	70	30	90	40	100

Exercises upon the Table; Addition.

1. To each number in line *a* add 2; add 3; 4; 5; 6; 7; 8; 9.

In the same way add 2, 3, 4, etc., to each number

2. In line *b*.
3. In line *c*.
4. In line *d*.
5. In line *e*.
6. In line *f*.
7. In line *g*.
8. In line *h*.
9. In line *i*.
10. In line *j*.

Exercises upon the Table; Subtraction.

11. Beginning with the second column of figures, from each number in line *a* take 2; take 3; 4; 5; 6; 7; 8; 9.

In the same way take 2, 3, 4, etc., from each number

12. In line *b*.
13. In line *c*.
14. In line *d*.
15. In line *e*.
16. In line *f*.
17. In line *g*.
18. In line *h*.
19. In line *i*.
20. In line *j*.

1. It took Clarence 28 minutes to learn his geography lesson, 7 to do his sums, and 6 to copy his spelling. He spent — minutes in all.

2. Lucy practiced 25 minutes before school, 10 minutes at noon, and 8 minutes after school. She spent — minutes in all.

3. Alice had 3 dimes, 1 nickel, and enough more money to make 42 cents. How many more cents had she? She had — more cents.

4. A newsboy bought 27 *Heralds*, 9 *Journals*, and 8 *Tribunes*. He bought — papers in all. He sold all of his papers but 6. How many papers did he sell?

5. The next day he sold 15 *Tribunes*, 8 *Times*, and 9 *Heralds*. How many papers did he sell on that day?

6. $34 + 7 - 2 + 5 + 8 - 9 - 6$ are how many?

The Number Twenty-one. 21.

• • • • • 7. In 1 row there are — dots; in 3
• • • • • rows there are 3 times — dots, or —
• • • • • dots. 3 times 7 = —.

8. In 1 column there are — dots, in 7 columns there are 7 times — dots, or — dots. 7 times 3 = —.

9. Show by blocks or a picture of squares, that $\frac{1}{3}$ of 21 is —. Show that $\frac{2}{3}$ of 21 are —.

By the use of marks, or splints or blocks if you need them, find out how many 4's there are in 21; how many 5's; 6's; 7's; etc. Then read and fill out:

10.

21 = Five 4's and —.

21 = — 5's and —.

21 = — 6's and —.

21 = — 8's and —.

21 = — 9's and —.

11.

$21 \div 4 = 5$ and — over.

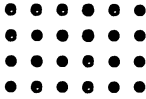
$21 \div 5 =$ — and — over.

$21 \div 6 =$ — and — over.

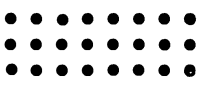
$21 \div 8 =$ — and — over.

$21 \div 9 =$ — and — over.

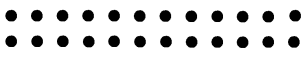
The Number Twenty-four. 24.

1. In 4 rows of 6 dots each there are  how many dots? In 6 columns of 4 dots each there are how many dots?

$4 \times 6 = ?$ $6 \times 4 = ?$ What is $\frac{1}{4}$ of 24? $\frac{1}{6}$ of 24?

 2. In 3 rows of 8 dots each there are — dots. In 8 columns of 3 dots each there are — dots.

3 times 8 are —, and 8 times 3 are —.

3. 24 dots can be arranged  in 2 rows of — dots each.

2 times 12 are —. 12 times 2 are —.

4. Add by 2's from 2 to 24. Subtract by 2's from 24.

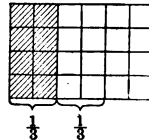
Copy and fill out the multiplication table of 2's; then learn to repeat it.

5. One 2 is —. Five 2's are —. Nine 2's are —.
Two 2's are —. Six 2's are —. Ten 2's are —.
Three 2's are —. Seven 2's are —. Eleven 2's are —.
Four 2's are —. Eight 2's are —. Twelve 2's are —.

6. Show by blocks or pictures of squares:

$\frac{1}{3}$ of 24; $\frac{2}{3}$ of 24. $\frac{1}{4}$ of 24; $\frac{3}{4}$ of 24.

7. Show $\frac{1}{3}$ of 24; $\frac{2}{3}$ of 24; $\frac{5}{6}$ of 24.



24 hours make 1 day.

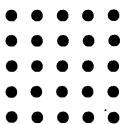
8. How many hours are there in $\frac{1}{3}$ of a day? in $\frac{1}{6}$ of a day? in $\frac{1}{4}$ of a day? in $\frac{3}{4}$ of a day?

9. 24 eggs are — dozen eggs; 24 months are — years.

10. 24 inches are — feet; 24 feet are — yards.

11. If you sleep 8 hours every day, what part of the 24 hours do you sleep?

12. If you play 4 hours every day, what part of the 24 hours do you play?

The Number Twenty-five. 25.

1. 25 dots in a square give — rows of — dots each. 5 times — are 25.

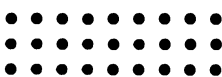
2. $5 \times 2 = ?$ $5 \times 3 = ?$ $5 \times 4 = ?$ $5 \times 5 = ?$

3. $\frac{1}{5}$ of 25 = ? $\frac{2}{5}$ of 25 = ? $\frac{3}{5}$ of 25 = ?

4. Count from 1 to 25 by 2's; by 3's; by 4's; by 6's.

5. With a quarter of a dollar (25 cents), how many tops at 4¢ each could you buy, and what would remain?

6. Tell what pieces of money you might get back if you should give a quarter of a dollar for something that costs 17 cents; that costs 11 cents; 7 cents.

The Numbers Twenty-seven and Twenty-eight. 27, 28.

7. 27 dots can be separated into how many groups of 9 each? Of 3 each?

8. How many yards are there in 27 feet?

9. How many feet are there in 27 inches?

10. Charles had 4 rows of strawberry plants, 7 in a row. How many strawberry plants did he have?

4 times 7 are how many? 7 times 4?

11. How many weeks are there in 28 days?

12. February has 28 days. When a week of the time has passed, how many days will be left?

13. Show by blocks or pictures of squares,

$\frac{1}{4}$ of 28; $\frac{2}{4}$ of 28. $\frac{1}{3}$ of 27; $\frac{2}{3}$ of 27. $\frac{4}{5}$ of 25.

Add the following:

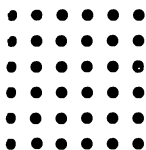
	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
14.	8	8	5	6	3	5	3	2
	3	2	3	3	7	3	6	7
	6	9	9	2	2	1	3	3
	3	4	3	5	4	3	7	2
	<u>19</u>	<u>16</u>	<u>17</u>	<u>12</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>16</u>

The Number Thirty. 30.

1. 5 rows of 6 dots each make — dots.
5 times 6 are —. 6 times 5 are —.
2. Ella put 30 squares of patchwork
in 5 rows of — squares each.
3. Count by 6's to 30. $\frac{1}{5}$ of 30 is —. $\frac{2}{5}$ of 30 are —.
4. Count by 5's to 30. $\frac{1}{6}$ of 30 is —. $\frac{2}{6}$ of 30 are —.
5. Willie had 30 words to spell, and missed $\frac{1}{5}$ of
them. How many words did he spell right?
6. Show by splints, how many there are in $\frac{1}{2}$ of 30;
in $\frac{1}{3}$ of 30.
7. "Thirty days hath September, April, June, and
November." How many weeks are there in September,
and how many days over?
8. Edwin began to go to school on the 5th of April.
How many more days remained in the month?
9. If Thanksgiving is on the 27th of November,
how many more days are there in the month?

The Numbers Thirty-two and Thirty-five. 32, 35.

10. In 4 rows of 8 dots each there
are — dots.
4 times 8 are —. 8 times 4 are —.
8 quarts make 1 peck.
4 pecks make 1 bushel.
11. How many quarts are there in a bushel?
12. In 5 rows of 7 dots each there
are — dots.
5 times 7 are —. 7 times 5 are —.
13. In 35 days there are — weeks.
14. In 3 dimes and 5 cents there are — cents.
15. A bushel of oats weighs 32 pounds. How many
pounds of oats are there in 1 peck?

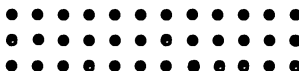
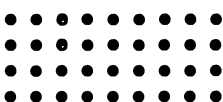
The Number Thirty-six. 36.

1. In a square made of dots, 6 dots on each side, there are — dots.

2. $6 \times 6 = ?$ $\frac{1}{6}$ of 36 = ? $\frac{5}{6}$ of 36 = ?

3. How many dots are there on the four sides of the square of 36 dots?

4. Arrange 36 dots in some other number of equal rows.



5. We can have 4 rows of — dots each, or we can have 3 rows of — dots each.

6. $36 = 6$ times —. $36 = 4$ times —. $36 = 3$ times —.

7. Add by 3's from 3 to 36. Subtract by 3's from 36.

Copy, fill out, and learn to repeat the following:

8.

One 3 is —. Five 3's are —. Nine 3's are —.
 Two 3's are —. Six 3's are —. Ten 3's are —.
 Three 3's are —. Seven 3's are —. Eleven 3's are —.
 Four 3's are —. Eight 3's are —. Twelve 3's are —.

Sight Exercise.

9. Multiply 3 3 3 3 3 3 3 3
 by 2 4 7 6 3 9 8 5 10

10. Show by blocks or pictures of squares:

$\frac{1}{3}$ of 36; $\frac{2}{3}$ of 36; $\frac{3}{4}$ of 36; $\frac{5}{6}$ of 36; $\frac{4}{5}$ of 36.

11. How many combs are there in 3 dozen combs?

12. In 36 quarts there are — gallons.

In 36 feet there are — yards.

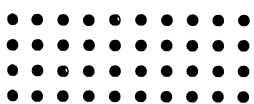
In 36 inches there are — feet.

In 36 pecks there are — bushels.

In 36 quarts there are — pecks and — quarts over.

In 36 days there are — weeks and — day over.

The Number Forty. 40.

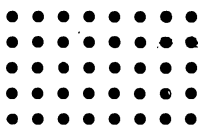


1. In 4 rows of 10 dots each, there are — dots. In 10 columns of 4 dots each, there are — dots.

2. $10 \times 4 = \text{—}$. $4 \times 10 = \text{—}$.

$\frac{1}{4}$ of 40 = —. $\frac{1}{10}$ of 40 = —.

3. Arrange 40 blocks or 40 dots in some other number of equal rows. We can have 5 rows of — blocks each.



4. $40 = 5$ times —, $= 8$ times —.

5. Add to 40 by 5's; by 8's.

6. How many blocks are there in 2 rows of 8 blocks each? in 3 rows of 8 blocks each? in 4 rows?

Show by blocks or squares:

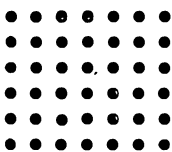
7. $\frac{1}{4}$ of 40. $\frac{3}{4}$ of 40. $\frac{1}{5}$ of 40. $\frac{2}{5}$ of 40. $\frac{3}{5}$ of 40.

8. $\frac{1}{8}$ of 40. $\frac{3}{8}$ of 40. $\frac{5}{8}$ of 40. $\frac{7}{8}$ of 40. $\frac{1}{2}$ of 40.

9. 40 cents = — dimes. 40 pecks = — bushels.

40 quarts = — gallons. 40 quarts = — pecks.

The Number Forty-two. 42.



10. In 6 rows of 7 dots each there are — dots. In 7 columns of 6 dots each there are — dots.

$7 \times 6 = ?$ $6 \times 7 = ?$

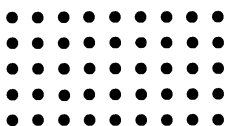
$\frac{1}{6}$ of 42 = ? $\frac{1}{7}$ of 42 = ?

11. If 6 spools of thread cost 42 cents, how much will 1 spool cost? 1 spool will cost $\frac{1}{6}$ of 42 cents. $\frac{1}{6}$ of 42 cents is — cents. Answer; — cents.

12. How many weeks' board at \$7 a week can be paid for with \$42?

13. Harry earns \$1 a day. If he works 6 days every week, in how many weeks will he earn \$42?

14. Add to 42 by 6's; by 7's.

The Number Forty-five. 45.

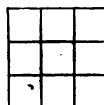
1. In 5 rows of 9 dots each, there are — dots. In 9 columns of 5 dots each, there are — dots.

$$\frac{1}{5} \text{ of } 45 = \text{—}. \quad \frac{1}{9} \text{ of } 45 = \text{—}.$$

2. In a square 3 feet long and 3 feet wide, there are — square feet.

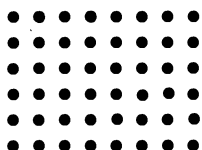
9 square feet make 1 square yard.

3. How many square yards are there in 45 square feet?



4. Add by 9's from 9 to 45. Count back by 9's from 45.

5. In 45 cents there are how many dimes?

The Number Forty-eight. 48.

6. In 6 rows of 8 dots each there are — dots. In 8 columns of 6 dots each there are — dots.

$$8 \times 6 = \text{—}. \quad \frac{1}{6} \text{ of } 48 = \text{—}.$$

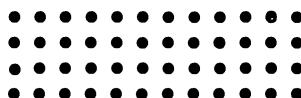
$$6 \times 8 = \text{—}. \quad \frac{1}{8} \text{ of } 48 = \text{—}.$$

7. Arrange 48 dots in some other number of equal rows.

8. We can have — rows of 12 dots each.

$$48 = 4 \text{ times —};$$

$$48 = 12 \text{ times —}.$$



9. In 48 inches there are how many feet?

10. Mr. Daly worked 8 hours a day for 6 days. How many hours did he work?

11. A gardener had 4 dozen cabbages; after selling a half-dozen, how many cabbages had he left?

12. At 6 cents a quart, how much will 8 quarts of berries cost? How much will 7 quarts cost?

1. Add by 4's from 4 to 48. Subtract by 4's from 48.

Copy, fill out, and learn to repeat the following :

2. One 4 is —. Five 4's are —. Nine 4's are —.
 Two 4's are —. Six 4's are —. Ten 4's are —.
 Three 4's are —. Seven 4's are —. Eleven 4's are —.
 Four 4's are —. Eight 4's are —. Twelve 4's are —.

Sight Exercise.

3. Multiply $\begin{array}{r} 4 \quad 4 \quad 4 \quad 4 \quad 4 \quad 4 \quad 4 \quad 4 \quad 4 \\ \text{by} \quad 2 \quad 5 \quad 3 \quad 7 \quad 6 \quad 4 \quad 10 \quad 8 \quad 9 \end{array}$

4. How many 4's are there in 4? in 8? in 16? in 24? in 12? in 20? in 36? in 32? in 40?

Show by pictures of squares:

5. $\frac{1}{4}$ of 48. 7. $\frac{1}{8}$ of 48. 9. $\frac{1}{6}$ of 48.
 6. $\frac{3}{4}$ of 48. 8. $\frac{3}{8}$ of 48. 10. $\frac{5}{6}$ of 48.

11. If you carry 4 sticks of wood at a time into the house, how many sticks do you carry in going 7 times?

12. I know a boy who carried 8 armfuls of wood for his mother. If there were 4 sticks in each armful, how many sticks did he carry?

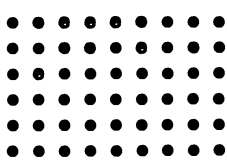
13. How many times must you fill a quart measure to measure a peck of plums? to measure a bushel?

14. If your brother is 6 years old, and your mother is 7 times as old as your brother, how old is your mother? If your father is 8 times as old as your brother, how old is your father?

15. How many pencils at 4 cents apiece can you buy for 4 dimes 1 nickel and 3 cents?

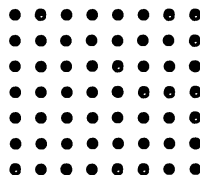
16. If I have 48 cherries, and Mary has $\frac{1}{4}$ as many, Mary has — cherries. If Emma has $\frac{3}{4}$ as many, Emma has — cherries.

The Numbers Fifty-four and Fifty-six. 54, 56.


 1. In 6 rows of 9 dots each,
 there are — dots. In 9 columns
 of 6 dots each, there are — dots.
 $9 \times 6 = \text{—}$. $\frac{1}{6}$ of 54 = —.
 $6 \times 9 = \text{—}$. $\frac{1}{9}$ of 54 = —.

2. In 7 rows of 8 dots each
 there are — dots. In 8 columns of
 7 dots each there are — dots.

$8 \times 7 = \text{—}$. $7 \times 8 = \text{—}$.
 $\frac{1}{7}$ of 56 = —. $\frac{1}{8}$ of 56 = —.
 $\frac{7}{8}$ of 56 = —. $\frac{8}{7}$ of 56 = —.



3. Count by 6's to 54; count back by 6's from 54.
4. Count by 9's to 54; count back by 9's from 54.
5. Count by 7's to 56; count back by 7's from 56.
6. Count by 8's to 56; count back by 8's from 56.
7. There are how many 10's and how many units in 54? in 56?

8. If you have 5 dimes and 4 cents, how many cents have you? If you have 5 dimes, a nickel, and 1 cent, how many cents have you?

9. Dora bought 6 spools of silk at 9 cents a spool. How many cents did she pay for them?

10. Eight spools of twist, at 7 cents a spool, will cost — cents.

11. With 54 cents I can buy — slates at 10 cents apiece and have — cents left.

12. With 56 cents I can buy — slates at 8 cents apiece.

13. Draw a picture of a slate 8 inches long and 7 inches wide. How many square inches does it contain?

14. How many square inches are there in a slate that is 9 inches long and 6 inches wide?

The Number Sixty. 60.

1. In 6 rows of 10 dots each, there are — dots. In 10 columns of 6 dots each, there are — dots.

$10 + 6 = \text{—}$. $\frac{1}{6}$ of 60 = —.
 $6 \times 10 = \text{—}$. $\frac{1}{10}$ of 60 = —.

2. Make 60 dots in some other number of equal rows.

3. Add by 5's to 60. Subtract from 60 by 5's.
 Copy, fill out, and learn to repeat the following :

4. One 5 is —. Five 5's are —. Nine 5's are —.
 Two 5's are —. Six 5's are —. Ten 5's are —.
 Three 5's are —. Seven 5's are —. Eleven 5's are —.
 Four 5's are —. Eight 5's are —. Twelve 5's are —.

Sight Exercise.

5. Multiply 5 5 5 5 5 5 5 5
 by 2 5 3 6 4 9 7 10 8

6. With 60 splints I can make — hexagons, or I can make — pentagons.

7. In 60 inches there are — feet.

8. In 60 cents there are — dimes.

9. In 60 quarts there are — pecks and — quarts over.

10. In 60 days there are — weeks and — days over.

60 minutes make 1 hour.

11. Find how many minutes there are in half an hour.

12. How many minutes are there in 10 minutes and 20 minutes and 10 minutes and 5 minutes?

60 seconds make 1 minute.

13. How many seconds are there in $\frac{1}{2}$ a minute?

1. Add by 6's to 60. Subtract from 60 by 6's.

Copy, fill out, and learn to repeat the following :

2. One 6 is —. Five 6's are —. Eight 6's are —.

Two 6's are —. Six 6's are —. Nine 6's are —.

Three 6's are —. Seven 6's are —. Ten 6's are —.

Four 6's are —.

Sight Exercise.

3. Multiply 6 6 6 6 6 6 6 6
by 2 5 3 6 4 8 7 10 9

Copy and divide each of the following numbers by 6, writing the answers as you see the answers written in the first examples :

4. $\begin{array}{r} 6 \overline{)12} \\ 2 \end{array}$ $\begin{array}{r} 42 \\ 2 \end{array}$ $\begin{array}{r} 24 \\ 2 \end{array}$ $\begin{array}{r} 36 \\ 2 \end{array}$ $\begin{array}{r} 18 \\ 2 \end{array}$ $\begin{array}{r} 48 \\ 2 \end{array}$ $\begin{array}{r} 60 \\ 2 \end{array}$ $\begin{array}{r} 30 \\ 2 \end{array}$ $\begin{array}{r} 54 \\ 2 \end{array}$

5. $\begin{array}{r} 6 \overline{)15} \\ 2 \end{array}$ $\begin{array}{r} 46 \\ 2 \end{array}$ $\begin{array}{r} 29 \\ 2 \end{array}$ $\begin{array}{r} 37 \\ 2 \end{array}$ $\begin{array}{r} 21 \\ 2 \end{array}$ $\begin{array}{r} 52 \\ 2 \end{array}$ $\begin{array}{r} 63 \\ 2 \end{array}$ $\begin{array}{r} 34 \\ 2 \end{array}$ $\begin{array}{r} 55 \\ 2 \end{array}$

Rem., 3.

6. Clara is 6 years old, and her father is 9 times as old as she is. How old is her father?

7. There are 6 working days in a week. In how many weeks are there 30 working days? 42 working days?

8. I bought 8 pounds of 6-cent sugar and gave in payment 5 dimes. How many cents should I receive back?

9. Alvin worked 3 hours at 6 cents an hour; how much money did he earn?

10. If 4 boys can weed a garden in 6 hours, in how many hours can 1 boy weed it?

11. If 4 oranges cost 24 cents, how much will 1 orange cost? how much will 5 oranges cost?

LESSON 65.

71

Add the following:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
1.	6	8	6	6	7	2	7	8
	7	7	7	6	2	5	6	2
	6	4	5	8	9	6	8	4
	5	4	6	7	6	7	8	9
	<u>18</u>	<u>19</u>	<u>27</u>	<u>36</u>	<u>18</u>	<u>25</u>	<u>27</u>	<u>28</u>
2.	9	9	6	9	9	9	6	9
	6	8	8	5	8	8	9	7
	8	7	9	5	5	9	8	4
	7	8	8	8	4	3	3	8
	<u>24</u>	<u>29</u>	<u>16</u>	<u>38</u>	<u>37</u>	<u>15</u>	<u>26</u>	<u>33</u>

Subtract the following:

	<i>i</i>	<i>j</i>	<i>k</i>	<i>l</i>	<i>m</i>	<i>n</i>	<i>o</i>	<i>p</i>
3.	22	22	32	32	42	42	42	42
	<u>3</u>	<u>9</u>	<u>3</u>	<u>9</u>	<u>3</u>	<u>9</u>	<u>4</u>	<u>8</u>
4.	32	32	62	62	52	52	72	72
	<u>4</u>	<u>8</u>	<u>4</u>	<u>8</u>	<u>5</u>	<u>7</u>	<u>5</u>	<u>7</u>
5.	82	82	102	102	23	23	43	43
	<u>5</u>	<u>7</u>	<u>5</u>	<u>7</u>	<u>4</u>	<u>9</u>	<u>4</u>	<u>9</u>
6.	63	63	83	83	23	23	33	33
	<u>4</u>	<u>9</u>	<u>4</u>	<u>9</u>	<u>5</u>	<u>8</u>	<u>5</u>	<u>8</u>
7.	53	53	83	83	13	13	33	33
	<u>5</u>	<u>8</u>	<u>5</u>	<u>8</u>	<u>6</u>	<u>7</u>	<u>6</u>	<u>7</u>
8.	53	53	73	73	14	14	24	24
	<u>6</u>	<u>7</u>	<u>6</u>	<u>7</u>	<u>5</u>	<u>9</u>	<u>5</u>	<u>9</u>

The Numbers Sixty-three and Sixty-four. 63, 64.

1. Count by 7's from 7 to 63. $63 = \text{— sevens}$.
Count by 9's from 9 to 63. $63 = \text{— nines}$. 7's in 63, —.
9's in 63, —.

2. Change 9 weeks to days. Since in 1 week there are — days, in 9 weeks there are 9 times — days, or — days.

3. Change 7 square yards to square feet. Since in 1 square yard there are — square feet, etc.

4. If board is \$1 a day, how much is it for a week? for 5 weeks? for 6 weeks? for 8 weeks?

5. At \$9 a week, how many weeks' board can be had for \$18? for \$27? for \$45? for \$54? for \$63?

6. At \$7 a barrel, how many barrels of flour can be bought for \$63? for \$56? for \$42? for \$28?

• • • • • 7. In each row there are — dots.
• • • • • There are — rows of dots.

• • • • • 8. Count by 8's to 64.

• • • • • 9. How many dots are 8 times 8
• • • • • dots?

• • • • • 10. Draw a square 8 inches long
• • • • • and 8 inches wide, and rule it off into
square inches. It contains — square inches.

11. Show how many square inches there are in $\frac{1}{8}$ of 64 square inches; in $\frac{2}{8}$, or $\frac{1}{4}$ of 64 square inches; in $\frac{3}{8}$ of 64 square inches; in $\frac{4}{8}$; in $\frac{5}{8}$.

12. There are 64 children in 8 equal rows. How many children are there in 1 row?

13. What is the cost of 1 pound of sugar when 8 pounds cost 56 cents? 64 cents? 48 cents? 32 cents? 40 cents?

14. Change 8 pecks to quarts. Change 8 quarts to gills.

The Number Seventy. 70.

1. How many are nine 7's? Ten 7's?
2. How much longer is a rope which measures 70 feet than one which measures 63 feet?
3. Add by 7's to 70. Subtract by 7's from 70. Copy, fill out, and learn to repeat the following :

4. One 7 is —.	Six 7's are —.
Two 7's are —.	Seven 7's are —.
Three 7's are —.	Eight 7's are —.
Four 7's are —.	Nine 7's are —.
Five 7's are —.	Ten 7's are —.

Sight Exercise.

5. Multiply 7 7 7 7 7 7 7 7 7 7
 by 5 3 6 2 8 1 4 7 9 10

Divide each of the following by 7:

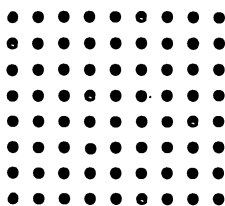
6. $7 \overline{)14}$ 28 21 42 49 35 63 70 56
 7. $7 \overline{)17}$ 30 26 46 53 41 65 73 60

8. 70 cents = — dimes. 70 days = — weeks.
9. 70 things = — dozen and —.
10. 70 minutes = — hour and — minutes.
11. In 1 there are $\frac{1}{7}$. In 10 there are $\frac{1}{7}$.
12. $10\phi = \frac{1}{10}$ of a dollar. $70\phi = \frac{1}{10}$ of a dollar.
 20 is sometimes called a score.
13. In 3 score years there are — years. In 3 score and 10 years there are — years.
14. How many spools of thread at 7¢ each can be bought for 70¢? for 49¢? for 56¢? for 63¢?

\$10 make 1 eagle.

15. \$50 = — eagles. \$70 = — eagles.

The Number Seventy-two. 72.



1. How many rows of dots are here? How many dots are there in each row?

2. Count the dots by 8's. Nine 8's are —.

Count the dots by 9's. Eight 9's are —.

3. An electric car goes at the rate of 8 miles an hour. How far will it go in 9 hours? in 7 hours? in 8 hours? in 6 hours?

4. A strawberry bed is 9 feet long and 8 feet wide. How many square feet does it contain?

5. How long is a book cover which contains 72 square inches and which is 8 inches wide?

6. How many square yards of carpeting will cover a room that is 9 yards long and 8 yards wide?

7. How many yards is it around a room 9 yards long and 8 yards wide?

8. Dora goes to school 9 months a year. How many months will she go in 7 years? in 8 years?

Copy and multiply the following, multiplying first the units, then the tens:

9. Multiply $\begin{array}{r} 34 \\ \times 2 \\ \hline \end{array}$ $\begin{array}{r} 24 \\ \times 2 \\ \hline \end{array}$ $\begin{array}{r} 33 \\ \times 2 \\ \hline \end{array}$ $\begin{array}{r} 43 \\ \times 2 \\ \hline \end{array}$ $\begin{array}{r} 23 \\ \times 3 \\ \hline \end{array}$ $\begin{array}{r} 42 \\ \times 3 \\ \hline \end{array}$ $\begin{array}{r} 52 \\ \times 4 \\ \hline \end{array}$

Copy and divide the following, dividing first the tens, then the units:

10. $2 \overline{)62}$ $2 \overline{)44}$ $2 \overline{)64}$ $2 \overline{)86}$ $2 \overline{)28}$ $2 \overline{)108}$
 11. $3 \overline{)33}$ $3 \overline{)63}$ $3 \overline{)66}$ $3 \overline{)36}$ $3 \overline{)69}$ $3 \overline{)89}$
 12. $2 \overline{)60}$ $4 \overline{)88}$ $3 \overline{)60}$ $2 \overline{)48}$ $3 \overline{)30}$ $4 \overline{)84}$ $2 \overline{)88}$

The Number Eighty. 80.

1. How many are nine 8's and one 8 more?
Ten 8's are how many?
2. 80 years are how many more years than 72 years?

Copy, fill out, and learn to repeat the following :

3. One 8 is —. Five 8's are —. Eight 8's are —
Two 8's are —. Six 8's are —. Nine 8's are —.
Three 8's are —. Seven 8's are —. Ten 8's are —.
Four 8's are —.

Sight Exercises.

4. Multiply 8 8 8 8 8 8 8 8 8
by 3 5 2 7 4 6 9 8 10

Divide each of the following by 8 :

5. $8 \overline{)16}$ $\underline{24}$ $\underline{40}$ $\underline{64}$ $\underline{56}$ $\underline{80}$ $\underline{72}$ $\underline{32}$ $\underline{48}$
6. $8 \overline{)17}$ $\underline{28}$ $\underline{43}$ $\underline{69}$ $\underline{59}$ $\underline{86}$ $\underline{79}$ $\underline{38}$ $\underline{55}$

7. How many are 8 times 5? 3? 4? 7? 2? 6? 8?
10? 9?

8. 8 times $5+4=?$ 9. 8 times $3+7=?$
8 times $7+5=?$ 8 times $6+8=?$
8 times $9+2=?$ 8 times $7+6=?$

10. 8 times $4+3=?$ 8 times $8+6=?$ 8 times $9+5=?$

11. Change 80 cents to dimes. Change 8 eagles to dollars.

12. How old is a man who has lived fourscore years?

13. How many more tens are 4 score than 3 score?

14. An octagon has — sides. How many octagons can be made with 80 splints? with 40? 56? 72?

15. What is $\frac{1}{2}$ of 8? of 80? 16. What is $\frac{1}{8}$ of 8? of 80?
What is $\frac{1}{4}$ of 8? of 80? What is $\frac{3}{8}$ of 8? of 80?
What is $\frac{3}{4}$ of 8? of 80? What is $\frac{5}{8}$ of 8? of 80?

Read and fill out the following :

1. In 1 there are $\frac{1}{10}$; in 8 there are $\frac{1}{10}$.

In 1 there are $\frac{1}{5}$; in 8 there are $\frac{1}{5}$.

In 1 there are $\frac{1}{4}$; in 8 there are $\frac{1}{4}$.

In 1 there are $\frac{1}{8}$; in 8 there are $\frac{1}{8}$.

In 1 there are $\frac{1}{8}$; in 8 there are $\frac{1}{8}$.

2. If 8 pencils cost 80 cents, how much will 1 cost?

If 8 pencils cost 80 cents, 1 pencil will cost $\frac{1}{8}$ of 80 cents. $\frac{1}{8}$ of 80 cents is — cents.

3. If it takes 80 shoes to shoe 10 oxen, how many shoes will it take to shoe 1 ox? If it takes 80 shoes to shoe 10 oxen, it will take $\frac{1}{10}$ of 80 shoes to shoe 1 ox. $\frac{1}{10}$ of 80 shoes is —.

Add the following :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
4.	6	9	9	9	8	5	9	9
	9	7	8	9	9	7	8	9
	8	9	8	8	4	6	4	8
	7	7	6	6	8	9	7	9
	<u>18</u>	<u>19</u>	<u>23</u>	<u>29</u>	<u>17</u>	<u>26</u>	<u>28</u>	<u>37</u>

Subtract the following :

5.	14	14	24	24	44	44	64	64
	<u>5</u>	<u>9</u>	<u>5</u>	<u>9</u>	<u>5</u>	<u>9</u>	<u>5</u>	<u>9</u>
6.	24	24	34	34	54	54	74	84
	<u>6</u>	<u>8</u>	<u>6</u>	<u>8</u>	<u>6</u>	<u>8</u>	<u>6</u>	<u>8</u>
7.	25	25	35	35	65	65	75	95
	<u>6</u>	<u>9</u>	<u>6</u>	<u>9</u>	<u>6</u>	<u>9</u>	<u>6</u>	<u>9</u>
8.	16	16	46	46	66	76	86	96
	<u>7</u>	<u>9</u>	<u>7</u>	<u>9</u>	<u>7</u>	<u>9</u>	<u>7</u>	<u>9</u>

The Number Eighty-one. 81.

1. In each row there are — dots.
There are — rows of dots.
2. Count the dots by 9's. Nine 9's are —.
3. A floor 9 feet long and 9 feet wide contains — square feet.
Such a floor is 9 feet square.
 9^2 means "9 square" or 9×9 .
4. Read and fill out the following:

$9^2 = 81$.	$6^2 = \text{—}$.	$3^2 = \text{—}$.
$8^2 = \text{—}$.	$5^2 = \text{—}$.	$2^2 = \text{—}$.
$7^2 = \text{—}$.	$4^2 = \text{—}$.	$1^2 = \text{—}$.
5. What is the square of 4? 6? 5? 7? 8? 9?
6. How many square feet are there in 1 square yard?
7. In 81 square feet there are how many square yards?
8. If a day's work is 9 hours, how many hours is 3 days' work? 5 days' work? 6 days' work? 7? 9? 8?
9. At \$9 a barrel for cranberries, how many barrels of cranberries can be bought for \$81? \$36? \$63? \$54?
10. What is the distance around a flower bed 9 feet square?
11. How many square feet are there in a flower bed 9 feet square?
12. Draw a plan of a flower bed 9 feet square, and show how many square feet there are in $\frac{2}{3}$ of it; in $\frac{4}{5}$; in $\frac{5}{8}$?
13. Show how many square feet there are in $\frac{1}{3}$ of the flower bed; in $\frac{2}{3}$.

13. If 1 man can do a piece of work in 90 days, 9 men can do the same work in what part of 90 days? What is $\frac{1}{9}$ of 90 days? What is $\frac{2}{9}$ of 90 days? $\frac{5}{9}$?

LESSON 73.

79

1. Since Helen was born, she has had 7 birthdays; her last one was 6 months ago. What is her age in years and months? in months?

2. Out of 9 packages of tea, each containing 10 pounds, 5 packages were sold. How many pounds were left?

Subtract the following:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>
3.	26	26	36	96	27	27	57	57
	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>8</u>	<u>9</u>	<u>8</u>	<u>9</u>
4.	37	37	77	77	18	38	68	98
	<u>8</u>	<u>9</u>	<u>8</u>	<u>9</u>	<u>9</u>	<u>9</u>	<u>9</u>	<u>9</u>
5.	45	53	66	36	48	77	42	54
	<u>7</u>	<u>8</u>	<u>9</u>	<u>7</u>	<u>9</u>	<u>8</u>	<u>7</u>	<u>6</u>
6.	31	101	92	92	83	103	64	98
	<u>7</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>5</u>	<u>7</u>	<u>7</u>	<u>4</u>

Give the sums of the following at sight:

7.	14	25	25	37	46	48	57	43
	<u>4</u>	<u>4</u>	<u>5</u>	<u>7</u>	<u>6</u>	<u>7</u>	<u>6</u>	<u>5</u>
8.	57	38	29	49	68	96	89	77
	<u>4</u>	<u>5</u>	<u>7</u>	<u>9</u>	<u>3</u>	<u>5</u>	<u>6</u>	<u>5</u>

Give the remainders at sight:

9.	11	21	21	43	43	54	54	84
	<u>2</u>	<u>2</u>	<u>9</u>	<u>4</u>	<u>9</u>	<u>6</u>	<u>8</u>	<u>5</u>
10.	22	22	52	52	74	104	64	56
	<u>8</u>	<u>4</u>	<u>9</u>	<u>3</u>	<u>7</u>	<u>7</u>	<u>9</u>	<u>8</u>

The Number One Hundred. 100.

1. Count by 10's to 100.

Copy, fill out, and learn to repeat the following :

2. One 10 is —. Six 10's are —.
 Two 10's are —. Seven 10's are —.
 Three 10's are —. Eight 10's are —.
 Four 10's are —. Nine 10's are —.
 Five 10's are —. Ten 10's are —.

3. In 100 there are how many 10's? 20's? 50's?

4. Copy and fill out the following table :

×	1	2	3	4	5	6	7	8	9	10
3	3	6	9	12	15	18	21			
5	5	10	15	20	25	30				
8	8	16	24	32	40					
4	4	8	12	16						
6	6	12								
9	9	18								
7	7	14								
2	2	4								
10	10									

5. 1 dollar = — cents. $\frac{1}{2}$ of a dollar = — cents.
 $\frac{1}{10}$ of a dollar = — cents. $\frac{1}{5}$ of a dollar = — cents.
 $\frac{3}{10}$ of a dollar = — cents. $\frac{2}{5}$ of a dollar = — cents.
 $\frac{7}{10}$ of a dollar = — cents. $\frac{4}{5}$ of a dollar = — cents.
6. $\$ \frac{1}{10} + \$ \frac{1}{10} = \$ \frac{2}{10} = \text{— } \phi$. 7. $\$ \frac{3}{5} + \$ \frac{2}{10} = \$ \frac{8}{10} = \text{— } \phi$.
 $\$ \frac{3}{10} + \$ \frac{2}{10} = \$ \frac{5}{10} = \text{— } \phi$. $\$ \frac{1}{2} + \$ \frac{1}{10} = \$ \frac{6}{10} = \text{— } \phi$.
 $\$ \frac{1}{5} + \$ \frac{2}{5} = \$ \frac{3}{5} = \text{— } \phi$. $\$ \frac{1}{2} + \$ \frac{3}{10} = \$ \frac{8}{10} = \text{— } \phi$.
 $\$ \frac{3}{5} + \$ \frac{1}{10} = \$ \frac{7}{10} = \text{— } \phi$. $\$ \frac{1}{2} + \$ \frac{5}{10} = \$ \frac{10}{10} = \text{— } \phi$.

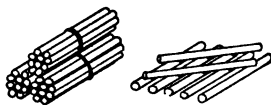
Addition of Tens and Units.

How many splints are 37 splints and 28 splints?

To add these numbers write them, units under units and tens under tens. First add the units then the tens.

Addends $\begin{array}{r} \text{t. u.} \\ 37 \\ 28 \\ \hline \end{array}$

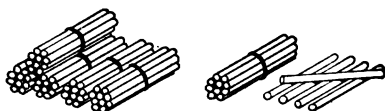
Sum 65



8 units + 7 units are 15 units. Write the five units in the units' place under the eight, and add the one ten to the tens.



1 ten + 2 tens + 3 tens are 6 tens. *Ans.* 65 splints.



The numbers to be added together are called **addends**. The number found by adding is called the **sum**.

What are the addends in the example above? What is the sum?

Examples in Addition.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
1.	$\begin{array}{r} 25 \\ 26 \\ \hline \end{array}$	$\begin{array}{r} 38 \\ 13 \\ \hline \end{array}$	$\begin{array}{r} 28 \\ 44 \\ \hline \end{array}$	$\begin{array}{r} 38 \\ 58 \\ \hline \end{array}$	$\begin{array}{r} 65 \\ 25 \\ \hline \end{array}$	$\begin{array}{r} 19 \\ 73 \\ \hline \end{array}$	$\begin{array}{r} 58 \\ 46 \\ \hline \end{array}$
2.	$\begin{array}{r} 57 \\ 37 \\ \hline \end{array}$	$\begin{array}{r} 67 \\ 14 \\ \hline \end{array}$	$\begin{array}{r} 48 \\ 48 \\ \hline \end{array}$	$\begin{array}{r} 49 \\ 35 \\ \hline \end{array}$	$\begin{array}{r} 58 \\ 24 \\ \hline \end{array}$	$\begin{array}{r} 54 \\ 19 \\ \hline \end{array}$	$\begin{array}{r} 29 \\ 27 \\ \hline \end{array}$
3.	$\begin{array}{r} 47 \\ 16 \\ \hline \end{array}$	$\begin{array}{r} 29 \\ 39 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ 29 \\ \hline \end{array}$	$\begin{array}{r} 36 \\ 29 \\ \hline \end{array}$	$\begin{array}{r} 37 \\ 33 \\ \hline \end{array}$	$\begin{array}{r} 36 \\ 46 \\ \hline \end{array}$	$\begin{array}{r} 49 \\ 54 \\ \hline \end{array}$
4.	$\begin{array}{r} 33 \\ 39 \\ \hline \end{array}$	$\begin{array}{r} 39 \\ 48 \\ \hline \end{array}$	$\begin{array}{r} 45 \\ 38 \\ \hline \end{array}$	$\begin{array}{r} 62 \\ 19 \\ \hline \end{array}$	$\begin{array}{r} 87 \\ 15 \\ \hline \end{array}$	$\begin{array}{r} 27 \\ 78 \\ \hline \end{array}$	$\begin{array}{r} 33 \\ 72 \\ \hline \end{array}$
5.	$\begin{array}{r} 26 \\ 55 \\ \hline \end{array}$	$\begin{array}{r} 44 \\ 48 \\ \hline \end{array}$	$\begin{array}{r} 35 \\ 35 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ 57 \\ \hline \end{array}$	$\begin{array}{r} 24 \\ 28 \\ \hline \end{array}$	$\begin{array}{r} 26 \\ 57 \\ \hline \end{array}$	$\begin{array}{r} 36 \\ 55 \\ \hline \end{array}$

Subtraction of Tens and Units.

From 42 splints take 29 splints.



4 tens and 2 units = 3 tens and 12 units.

(8)(12) To subtract 29 from 42 we write the less number beneath the greater, units under units, tens under tens. We first subtract the units, then the tens.

$$\begin{array}{r} \text{Minuend } 42 \\ \text{Subtrahend } 29 \\ \hline \text{Remainder } 13 \end{array}$$

As there are but 2 units to take the 9 units from, one of the 4 tens is put with the 2 units, making 12 units. 9 units from 12 units leaves 3 units. 2 tens from 3 tens leaves 1 ten.

Ans. 13 splints.

When a number is subtracted from another number, the larger number is called the **minuend**. The smaller number is called the **subtrahend**. The part of the minuend left after the subtrahend is taken away is the **remainder**.

In the example above, what is the minuend? What is the subtrahend? What is the remainder?

Examples in Subtraction.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
1.	$\begin{array}{r} 32 \\ 24 \\ \hline \end{array}$	$\begin{array}{r} 52 \\ 36 \\ \hline \end{array}$	$\begin{array}{r} 42 \\ 27 \\ \hline \end{array}$	$\begin{array}{r} 63 \\ 24 \\ \hline \end{array}$	$\begin{array}{r} 83 \\ 56 \\ \hline \end{array}$	$\begin{array}{r} 43 \\ 27 \\ \hline \end{array}$	$\begin{array}{r} 82 \\ 35 \\ \hline \end{array}$
2.	$\begin{array}{r} 41 \\ 23 \\ \hline \end{array}$	$\begin{array}{r} 61 \\ 26 \\ \hline \end{array}$	$\begin{array}{r} 91 \\ 35 \\ \hline \end{array}$	$\begin{array}{r} 71 \\ 44 \\ \hline \end{array}$	$\begin{array}{r} 80 \\ 15 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ 27 \\ \hline \end{array}$	$\begin{array}{r} 50 \\ 33 \\ \hline \end{array}$
3.	$\begin{array}{r} 60 \\ 46 \\ \hline \end{array}$	$\begin{array}{r} 90 \\ 24 \\ \hline \end{array}$	$\begin{array}{r} 80 \\ 39 \\ \hline \end{array}$	$\begin{array}{r} 40 \\ 18 \\ \hline \end{array}$	$\begin{array}{r} 81 \\ 27 \\ \hline \end{array}$	$\begin{array}{r} 61 \\ 19 \\ \hline \end{array}$	$\begin{array}{r} 71 \\ 22 \\ \hline \end{array}$

Add, beginning at the bottom; and to prove that your work is right, add each column a second time, beginning at the top.

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
1.	21	38	24	54	10	28	37
	17	23	14	19	47	39	28
	<u>59</u>	<u>33</u>	<u>55</u>	<u>39</u>	<u>29</u>	<u>29</u>	<u>28</u>
2.	42	39	57	49	28	18	19
	26	58	38	20	47	24	67
	<u>39</u>	<u>18</u>	<u>11</u>	<u>37</u>	<u>32</u>	<u>59</u>	<u>28</u>

Subtract; and to prove that your work is right, add together the remainder and subtrahend. The sum ought to equal the minuend.

3.	90	50	91	52	82	62	73
	<u>12</u>	<u>21</u>	<u>48</u>	<u>28</u>	<u>39</u>	<u>23</u>	<u>45</u>
4.	83	93	34	74	84	64	94
	<u>68</u>	<u>49</u>	<u>15</u>	<u>26</u>	<u>37</u>	<u>18</u>	<u>29</u>
5.	65	85	75	85	66	86	96
	<u>27</u>	<u>28</u>	<u>29</u>	<u>46</u>	<u>37</u>	<u>58</u>	<u>39</u>

Find the amounts of the following purchases:

6. Olives 35¢, dates 12¢, celery 26¢, apples 25¢.
7. Ham 18¢, sugar 27¢, baking powder 45¢, eggs 36¢.
8. Tomatoes 24¢, bacon 15¢, oranges 18¢, cocoa 25¢.
9. Potatoes 25¢, vanilla 28¢, beef 56¢, corn 18¢.

Find what would be left of one dollar after buying with it:

10. Squash 26¢, chops 35¢, coffee 38¢.
11. Lamb 13¢, chicken 56¢, oranges 18¢, currants 13¢.
12. Bananas 15¢, corn 17¢, steak 28¢, celery 17¢.
13. Lettuce 8¢, walnuts 18¢, mixed nuts 52¢, soap 19¢.

14. Five dozen buttonholes were worked for 90 cents; what was the price per dozen? What was the cost of working one buttonhole?

15. If it requires 9 men 10 days to take the census of a town, how many men will it require to do it in 1 day? How many days would it require for 1 man to do it?

Here is the plan of a garden; each square represents 1 square rod:

1	2	3	4
5	6	7	8
9	10	11	12

16. On the first 4 rods were raised 2 bushels of early potatoes to a rod. If sold at $\$1\frac{1}{2}$ a bushel, how much did all bring?

Later in the season there was raised upon the same ground, celery, which brought three times as much as the potatoes. How much did the celery bring? How much did both crops bring?

17. On each of the next four rods were planted 5 rows of early corn, 5 hills to a row; how many hills were there in 1 rod? in the 4 rods? If it took 2 hills to yield 1 dozen ears, how many dozen did all yield?

For a second crop turnips were sown; each of the 4 rods yielded 4 bushels. How many bushels did all yield? If these sell at $\$ \frac{1}{2}$ per bushel, how much do they come to? The corn brings twice as much as the turnips; how much do both these crops bring?

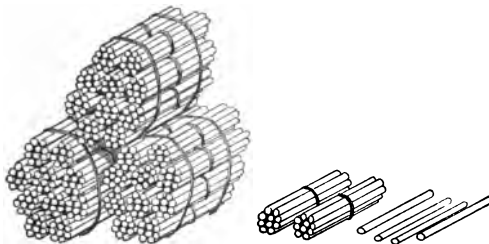
18. Lettuce and cabbages were grown upon the remaining four rods, 24 dozen heads of lettuce to each square rod, and $\frac{1}{4}$ as many dozen heads of cabbage. How many dozen of each were produced?

19. If cabbages sell at 8 cents a head and lettuce at 3 cents, how much will a half dozen of each sell for?

PART II.

NUMBERS TO TEN THOUSANDS.

NOTATION AND NUMERATION.



ARTICLE 1. Three hundreds + two tens + four units
= 324.

$$300 + 20 + 4 = 324.$$

Exercises.

2. Form with splints and write :

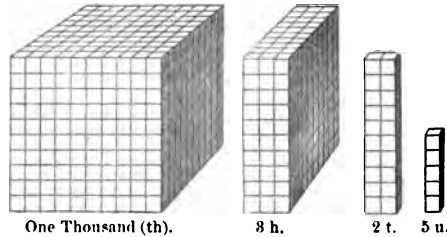
- | | |
|----------------------------|-------------------------|
| 1. One hundred eleven. | 4. Three hundred seven. |
| 2. One hundred thirty-two. | 5. Three hundred forty. |
| 3. Two hundred nine.* | 6. Four hundred ninety. |

3. Read the following, and tell how many hundreds (h.), tens (t.), and units (u.), each number is made up of :

7. $534 = 5 \text{ h. } 3 \text{ t. and } 4 \text{ u.}$

- | | | | |
|---------|----------|----------|----------|
| 8. 427. | 10. 680. | 12. 748. | 14. 216. |
| 9. 743. | 11. 507. | 13. 325. | 15. 902. |

* 209. The zero is used to fill the vacant place.

Numbers made up of Thousands, Hundreds, Tens, and Units.

4. Ten hundreds make 1 thousand. Thousands are written thus,

One thousand, 1000. Two thousand, 2000.
Three thousand, 3000, and so on.

One thousand three hundred twenty-five is written thus, 1325.
In which place from the right are thousands written ?

5. Read the following :

- | | | | |
|------------------|------------------|------------------|------------------|
| 16. 1476. | 18. 2347. | 20. 8074. | 22. 1098. |
| 17. 1032. | 19. 4805. | 21. 5040. | 23. 9803. |

Tell how many thousands, hundreds, tens, and units each number that is written above is made up of ; thus,

1476 equals 1 thousand, 4 hundreds, 7 tens, 6 units.

6. Write in figures :

- 24.** One thousand three hundred.
- 25.** Two thousand five hundred seventy-four.
- 26.** Four thousand one hundred forty-three.
- 27.** Nine thousand six hundred fifty.
- 28.** Eight thousand fifty-nine.
- 29.** Seven thousand four hundred.
- 30.** Six thousand five hundred seven.

- | | |
|---------------------------------|-----------------------|
| 31. 3 th. 4 h. 9 t. 3 u. | 34. 7 th. 6 u. |
| 32. 5 th. 0 h. 6 t. 8 u. | 35. 9 th. 4 t. |
| 33. 2 th. 3 h. 2 t. 0 u. | 36. 8 th. 6 h. |

Oral Exercises for Occasional Drill.

The exercises on the next three pages may be taken as drill exercises in connection with the work which follows.

7. Giving answers only, add the following :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>	<i>j</i>
1.	6	7	8	9	4	5	5	2	4	8
	<u>46</u>	<u>37</u>	<u>58</u>	<u>39</u>	<u>66</u>	<u>27</u>	<u>29</u>	<u>59</u>	<u>68</u>	<u>99</u>

2.	3	2	5	6	7	5	7	9	5	4
	<u>84</u>	<u>98</u>	<u>89</u>	<u>94</u>	<u>85</u>	<u>96</u>	<u>84</u>	<u>93</u>	<u>95</u>	<u>99</u>

3.	8	3	6	9	6	5	4	7	5	6
	<u>87</u>	<u>68</u>	<u>74</u>	<u>88</u>	<u>39</u>	<u>28</u>	<u>77</u>	<u>96</u>	<u>77</u>	<u>43</u>

4.	30	30	60	40	20	30	80	50	90	10
	<u>60</u>	<u>70</u>	<u>80</u>	<u>70</u>	<u>80</u>	<u>90</u>	<u>90</u>	<u>80</u>	<u>60</u>	<u>90</u>

	<i>k</i>	<i>l</i>	<i>m</i>	<i>n</i>	<i>o</i>	<i>p</i>	<i>q</i>	<i>r</i>
5.	90	20	50	90	70	90	40	60
	<u>110</u>	<u>170</u>	<u>160</u>	<u>280</u>	<u>290</u>	<u>360</u>	<u>380</u>	<u>460</u>

6.	40	50	70	800	300	600	300	700
	<u>20</u>	<u>10</u>	<u>30</u>	<u>500</u>	<u>800</u>	<u>800</u>	<u>900</u>	<u>500</u>
	<u>190</u>	<u>280</u>	<u>350</u>	<u>400</u>	<u>800</u>	<u>700</u>	<u>900</u>	<u>700</u>

8. $5+8+6+7+5+8+7+7+6+3+8+2+9=?$

8. $3+9+5+6+9+7+6+8+4+8+3+6+8=?$

9. $3+5+4+7+5+7+7+8+6+7+8+7+8+6=?$

10. $6+5+6+4+8+6+8+8+6+6+4+9+7+6=?$

11. $120-5-4-6-8-6-6-8-9-5-7-8-7=?$

12. If you have quarters (25¢ pieces), dimes, nickels, and 1-cent pieces, what are the fewest pieces of money with which you can pay 48¢? 35¢? 17¢? 33¢? 28¢? 62¢? 54¢? 42¢? 84¢? 98¢?

9. 13. Multiply each of the following numbers by 2 and add 1:

1, 2, 7, 9, 3, 8, 4, 6, 5.

14. Multiply the same numbers by 3 and add 2.

15. Multiply them by 4 and add 3.*

16. Multiply them by 5 and add 4.*

17. Multiply them by 6 and add 5.*

18. Multiply them by 7 and add 6.*

19. Multiply them by 8 and add 7.*

20. Multiply them by 9 and add 8.*

21. Multiply them by 10 and add 9.*

10. 22. Add by 9's to 108.

In 108 there are — 9's ; there are — 12's.

23. Add by 10's to 120.

In 120 there are — 10's ; there are — 12's.

24. Add by 11's to 132.

In 132 there are — 11's ; there are — 12's.

25. Add by 12's to 144. In 144 there are — 12's.

26. How many 9's are there in 99 ? in 108 ?

27. How many 11's are there in 99 ? in 110 ? in 132 ? in 121 ? in 88 ? in 77 ?

28. How many 12's are there in 72 ? in 96 ? in 108 ? in 144 ? in 120 ? 132 ?

11. 29. Repeat the multiplication table of 6's to 12 times 6.

30. Of 7's to 12 times 7. **33.** Of 10's to 12 times 10.

31. Of 8's to 12 times 8. **34.** Of 11's to 12 times 11.

32. Of 9's to 12 times 9. **35.** Of 12's to 12 times 12.

12. 36. Name the number the square of which is 9; 25 ; 16 ; 36 ; 64 ; 49 ; 81 ; 100.

* Or any smaller number.

13. 37. 40 are how many times 2? 4? 5? 6? 7? 8? 9? 10? 11? 12?

38. 50 are how many times 4? 8? 6? 7? 9? 12?

39. 100 are how many times 4? 5? 10? 20? 50?

40. Name two numbers whose product is 56, 24, 27, 48, 45, 44, 42, 40, 54, 35, 49, 32, 100.

41. Name two numbers whose product is 28, 22, 49, 63, 70, 60, 64, 66, 80, 77, 72, 81, 96, 88, 99.

42. Name two numbers whose product is 108, 121, 110, 144, 132.

14. 43. Add by 2's to 12; by 20's to 120.

44. Add by 4's to 12; by 40's to 120.

45. $100 = -10's = -20's = -50's = -5's = -4's$.

46. $120 = -10's = -20's = -60's = -30's = -40's$.

47. $60 = -10's = -20's = -30's = -15's = -12's$.

15. 48. What part of 10 is 2? of 100 is 20?

49. What part of 12 is 6? of 120 is 60?

50. What part of 12 is 3? of 120 is 30?

16. 51. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{7}{8}$.

52. $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{1}{1}$.

53. $\frac{1}{2} + \frac{3}{4} + \frac{3}{8} = \frac{11}{8} = 1\frac{3}{8}$.

54. $\$ \frac{1}{2} + \$ \frac{2}{5} + \$ \frac{1}{10} = \$ \frac{7}{10} = \text{— cents.}$

17. 55. Change to ounces and add $\frac{1}{2}$ of a pound, $\frac{3}{8}$ of a pound, and $\frac{3}{4}$ of a pound.

56. Change to cents and add $\$ \frac{3}{4}$, $\$ \frac{1}{2}$, $\$ \frac{1}{10}$, and $\$ \frac{1}{5}$.

57. 2 hours = — minutes. 120 seconds = — minutes.

58. Change 120 cents to dimes; 12 dimes to cents.

59. How many bales of cotton, 8 bales to an acre, will $12\frac{1}{2}$ acres yield?

60. How many bushels of corn to an acre can be harvested if each 3 acres yields 120 bushels?

18. Oral Examples.

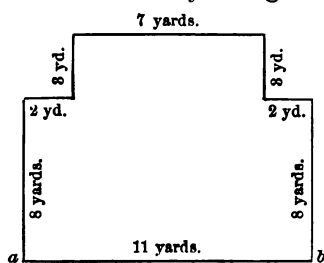
1. Julia has 8 sheep; her father has 8 times as many. How many have both?

2. How many gallons are there in 24 pints? in 48 pints? in 64 pints? in 88 pints?

3. 4 horses are fed each 3 quarts of oats 3 times a day; how many quarts will they eat in 1 day? in 2 days?

4. If a cow gives 6 quarts of milk at night and 4 quarts in the morning, how much does she give in 1 week? in 2 weeks?

5. One half of a box of 200 oranges was sold at wholesale; out of the other half were sold 5 dozen and 20. How many oranges remained?



6. How many yards of paper will border a room of the dimensions given in the cut?

7. If the room is 9 feet high, how many square yards are there on the wall *ab*?

8. How many square yards are there on the two end walls?

9. How many square yards are there on the floor, counting the bay?

10. A farmer raised 120 bushels of oats on 2 acres of land. How many bushels was this to an acre? to $\frac{1}{2}$ of an acre? to $\frac{1}{3}$ of an acre?

11. Philip picked 9 quarts of berries; his brother picked twice as many. How many quarts did both pick? How many pecks?

12. Philip was 9 years old in 1893. In what year was he born? In what year will he be 21?

ADDITION AND SUBTRACTION.

19. Examples for Written Work.

Add from below upward and prove :

	1.	2.	3.	4.	5.	6.	7.
	22	33	34	44	45	55	55
	22	33	34	44	45	55	55
	22	33	34	44	45	55	55
	22	33	34	44	45	55	55
	<u>22</u>	<u>33</u>	<u>34</u>	<u>11</u>	<u>15</u>	<u>21</u>	<u>12</u>
		8.	9.	10.	11.	12.	13.
From		607	908	509	907	808	723
take		<u>213</u>	<u>598</u>	<u>223</u>	<u>482</u>	<u>556</u>	<u>683</u>
		14.	15.	16.	17.	18.	19.
From		710	618	819	715	916	625
take		<u>520</u>	<u>495</u>	<u>437</u>	<u>180</u>	<u>643</u>	<u>543</u>
	20.	21.	22.	23.	24.	25.	26.
Add :	66	66	66	77	77	77	87
	66	66	66	77	77	77	87
	66	66	66	77	77	77	87
	66	66	66	77	77	77	87
	<u>66</u>	<u>61</u>	<u>25</u>	<u>27</u>	<u>16</u>	<u>11</u>	<u>82</u>
	27.	28.	29.	30.	31.	32.	
	1252	1452	1563	1183	1164	1074	
	<u>-647</u>	<u>-635</u>	<u>-725</u>	<u>-828</u>	<u>-456</u>	<u>-558</u>	
	33.	34.	35.	36.	37.	38.	
	1175	1295	1675	1466	1596	1787	
	<u>-526</u>	<u>-849</u>	<u>-967</u>	<u>-559</u>	<u>-837</u>	<u>-879</u>	

Add from below upward and prove :

39.	40.	41.	42.	43.	44.
88	88	88	99	99	99
88	88	88	99	99	99
88	88	88	99	99	99
88	88	88	99	99	99
<u>38</u>	<u>31</u>	<u>15</u>	<u>49</u>	<u>43</u>	<u>24</u>

45.	46.	47.	48.	49.	50.
323	236	545	344	225	133
<u>+597</u>	<u>+776</u>	<u>+379</u>	<u>+486</u>	<u>+696</u>	<u>+888</u>

51.	52.	53.	54.	55.	56.
246	356	248	758	639	537
<u>+775</u>	<u>+677</u>	<u>+895</u>	<u>+395</u>	<u>+585</u>	<u>+769</u>

57.	58.	59.	60.	61.	62.
320	320	418	418	209	209
<u>-90</u>	<u>-230</u>	<u>-95</u>	<u>-323</u>	<u>-89</u>	<u>-120</u>

63.	64.	65.	66.	67.	68.
420	420	421	421	432	432
<u>-89</u>	<u>-331</u>	<u>-178</u>	<u>-243</u>	<u>-65</u>	<u>-367</u>

69.	70.	71.	72.	73.	74.
228	228	437	437	346	346
<u>-89</u>	<u>-139</u>	<u>-89</u>	<u>-348</u>	<u>-97</u>	<u>-249</u>

75.	76.	77.	78.	79.	80.
200	200	306	306	600	600
<u>-12</u>	<u>-188</u>	<u>-59</u>	<u>-247</u>	<u>-197</u>	<u>-403</u>

81.	82.	83.	84.	85.	86.
1489	1758	1847	1378	1754	1439
<u>-993</u>	<u>-885</u>	<u>-895</u>	<u>-484</u>	<u>-259</u>	<u>-672</u>

United States Money.

- 20.** 10 cents (¢) make 1 dime (d.).
 10 dimes make 1 dollar (\$).
 100 cents make 1 dollar.

Examples for Written Work.

21. 1. What is the sum of \$32, \$45, \$108, \$17, and \$39?

2. What is the sum of 16¢, 34¢, 28¢, 8¢, and 27¢?

Dollars and cents are written together. Thus, 2 dollars, 45 cents, are written \$2.45. As 100 cents make 1 dollar, \$2.45 is just the same as 245 cents; \$15.30 is the same as 1530 cents.

Add the following:

3.	4.	5.	6.	7.
\$306	\$2.42	\$3.15	\$18.19	\$56.27
728	3.24	5.32	36.21	42.81
547	7.08	3.28	48.64	17.48
329	6.57	4.32	32.85	63.92
<u>543</u>	<u>8.65</u>	<u>5.71</u>	<u>9.08</u>	<u>16.35</u>

8.	9.	10.	11.	12.
\$75.31	\$3.00	\$9.19	\$54.89	\$19.18
82.90	14.09	3.05	31.42	71.22
61.54	76.50	41.02	61.17	13.15
32.05	34.21	21.85	1.82	4.32
17.14	22.08	13.62	18.09	6.94
81.02	4.35	75.08	5.89	17.89
9.15	54.54	9.75	13.45	4.15
<u>14.25</u>	<u>7.89</u>	<u>18.82</u>	<u>16.89</u>	<u>29.18</u>

13.	14.	15.	16.	17.
\$4.60	\$22.40	\$16.48	\$7.84	\$38.02
2.87	74.09	7.42	8.36	15.71
5.30	53.67	17.98	3.69	8.28
6.84	14.76	4.34	0.49	45.31
0.19	66.67	0.85	29.34	8.92
4.76	7.28	9.28	45.08	10.37
7.34	31.08	3.17	46.50	84.42
1.95	13.37	6.51	27.31	76.35

In adding the numbers in the following examples, write them *dollars under dollars and cents under cents.*

18. If you buy a coat for \$10.50, gloves for 75¢, some handkerchiefs for \$2.25, boots for \$4.62, and a hat for \$2.87, how much must you pay for all?

19. If Dora buys some gloves for \$1.25, boots for \$4.37, velvet for \$1.92, silesia for 56¢, and pays \$14.75 for a sack, what must she pay for all?

Find the sum of the following items of accounts:

20. A fountain pen, \$1.75; stationery, 44¢; postage, 25¢; mucilage, 12¢; rubber bands, 87¢; blank books, 74¢.

21. Flour, \$5.25; butter, \$1.83; raisins, 50¢; sugar, \$5.81; canned goods, 96¢; apples, \$2.00.

Dry goods—

22.	Sept. bill,	\$25.74
	Oct. bill,	28.32
	Nov. bill,	32.83
	Dec. bill,	31.08
	Jan. bill,	29.18
	Feb. bill,	26.40

Furniture—

23.	Chair,	\$5.90
	Mattress,	16.67
	Chamber Set,	44.00
	Rocker,	15.50
	Bureau,	13.00
	Desk,	17.63

22. Perform the following :

24. \$ 2.62 <u>-1.25</u>	25. \$ 21.40 <u>-15.36</u>	26. \$ 33.62 <u>-26.16</u>	27. \$ 42.34 <u>-14.05</u>	28. \$ 73.85 <u>-65.16</u>
29. \$ 80.91 <u>-25.44</u>	30. \$ 37.44 <u>-29.38</u>	31. \$ 45.60 <u>-27.34</u>	32. \$ 32.05 <u>-17.54</u>	33. \$ 40.82 <u>-34.15</u>
34. \$ 4.00 <u>-2.85</u>	35. \$ 25.02 <u>-12.59</u>	36. \$ 28.00 <u>-17.69</u>	37. \$ 27.28 <u>-5.79</u>	38. \$ 86.42 <u>-35.69</u>

39. Mr. Reed bought a horse for \$ 279, and sold him for \$ 350. How many dollars did he gain ?

40. Frances took \$ 10.95 to the store and bought with it a silk waist for \$ 6.87 cents. How much money had she left ?

41. A house and barn together were worth \$ 9900; the barn was worth \$ 856. How much was the house worth ?

42. If you earn \$ 17.45, and spend \$ 9.88 for clothes, how much money will you have left ?

43. Mary has \$ 32.61, Charlotte has \$ 8.29 more than Mary. How much money have both ?

44. A man borrowed \$ 3850, and paid at one time \$ 640, at another time \$ 850. How much did he then owe ?

45. A farmer built a barn, paying for lumber \$ 650, for carpenter's work \$ 420, for hardware \$ 95, and for painting \$ 60. How much did he pay in all ?

46. The balance due on a depositor's bank book the first of May was \$ 84.40; May fifteenth he drew out \$ 16.85, and May twentieth he deposited \$ 73.68. What was the balance then remaining in the bank ?

MULTIPLICATION.

23. Illustrative Examples. — (1) How many splints are there in 3 piles of 46 splints each? (2) How much will 3 yards of velvet cost at \$2.46 a yard?

WRITTEN WORK.

	(1)	(2)
Multiplicand,	46	\$ 2.46
Multiplier,	3	3
Product,	<u>138</u>	<u>\$ 7.38</u>

Multiply first the units, then the tens, then the hundreds.

(1) Three times 6 units are 18 units; write the 8 units in the units' place under the line, and keep the 1 ten to add with the tens. 3 times 4 tens are 12

tens, which with 1 ten added gives 13 tens.

(1) *Ans.* 138 splints. (2) *Ans.* \$7.38.

24. When one number is multiplied by another number, the number multiplied is the **multiplicand**. The number used to multiply by is the **multiplier**. The answer is the **product**.

In example (2) above, what is the multiplicand? the multiplier? the product?

By means of splints, show how 46 is multiplied by 3.

25. Examples for Written Work.

1.	2.	3.	4.	5.	6.	7.	8.
19	58	76	45	76	98	57	48
<u>× 2</u>	<u>× 2</u>	<u>× 2</u>	<u>× 3</u>	<u>× 3</u>	<u>× 3</u>	<u>× 4</u>	<u>× 4</u>
9.	10.	11.	12.	13.	14.	15.	16.
69	29	38	47	65	27	38	49
<u>× 4</u>	<u>× 5</u>	<u>× 5</u>	<u>× 5</u>	<u>× 5</u>	<u>× 6</u>	<u>× 6</u>	<u>× 6</u>
17.	18.	19.	20.	21.	22.	23.	24.
56	26	43	95	78	29	48	63
<u>× 6</u>	<u>× 7</u>	<u>× 7</u>	<u>× 7</u>	<u>× 7</u>	<u>× 8</u>	<u>× 8</u>	<u>× 8</u>
25.	26.	27.	28.	29.	30.	31.	32.
57	29	38	47	56	29	53	77
<u>× 8</u>	<u>× 9</u>	<u>× 9</u>	<u>× 9</u>	<u>× 9</u>	<u>× 6</u>	<u>× 7</u>	<u>× 8</u>

DIVISION.

26. Illustrative Example. — How many excursion tickets at \$4 each can be bought for \$864?

WRITTEN WORK. As many tickets at \$4 each can be bought for 864 as there are 4's in 864.
 Dividend To divide 864 by 4, write the 864 with the 4 at the left and draw a curved line between them. Divide first the hundreds, next the tens, and then the units.

Divisor 4)864
 Quotient 216

8 ÷ 4 equals 2; write the 2 under the 8 in the hundreds' place.
 6 ÷ 4 equals 1 with a remainder of 2; write the 1 under the 6 in the tens' place.
 The remainder is 2 tens, which with the 4 units makes 24 units.
 24 ÷ 4 equals 6; write the 6 under the 4, in the units' place.
 Ans. 216 tickets.

27. When one number is divided by another number, the number divided is the **dividend**. The number used to divide by is the **divisor**. The answer is the **quotient**.

In the example above, what is the dividend? the divisor? the quotient?

By means of splints show how 238 is divided by 2.

28. Examples for Written Work.

1. 2)432	2. 2)634	3. 2)856	4. 2)478	5. 3)684
6. 3)975	7. 3)426	8. 3)750	9. 3)819	10. 4)876

11. Change 948 feet to yards.
12. Change 764 pecks to bushels.
13. A conductor received 892 cents in 4-cent fares. How many passengers were paid for?

29. The work in division can be proved by multiplying the divisor and quotient together. The product should equal the dividend.

Perform and prove the following examples :

14. $4 \overline{)960}$	15. $4 \overline{)132}$	16. $4 \overline{)156}$	17. $4 \overline{)728}$	18. $5 \overline{)575}$
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19. $5 \overline{)650}$	20. $5 \overline{)855}$	21. $5 \overline{)140}$	22. $5 \overline{)185}$	23. $5 \overline{)427}$
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$5 \overline{)427} - 2$ In example 23, after dividing 427 by 5, there is a remainder of 2, which is written at the right of the dividend.
85

NOTE.—In proving the work, the remainder must be added to the product of the divisor and quotient.

24. $3 \overline{)437}$	25. $3 \overline{)708}$	26. $4 \overline{)927}$	27. $4 \overline{)945}$	28. $5 \overline{)747}$
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MULTIPLICATION AND DIVISION.

30. In the examples in multiplication that follow, prove the work by dividing the product by the multiplier. The quotient should equal the multiplicand.

1. $\begin{array}{r} 518 \\ \times 2 \\ \hline \end{array}$	2. $\begin{array}{r} 645 \\ \times 2 \\ \hline \end{array}$	3. $\begin{array}{r} 414 \\ \times 3 \\ \hline \end{array}$	4. $\begin{array}{r} 262 \\ \times 4 \\ \hline \end{array}$	5. $\begin{array}{r} 151 \\ \times 7 \\ \hline \end{array}$	6. $\begin{array}{r} 251 \\ \times 5 \\ \hline \end{array}$
-----------------------------------------------------------------------	-----------------------------------------------------------------------	-----------------------------------------------------------------------	-----------------------------------------------------------------------	-----------------------------------------------------------------------	-----------------------------------------------------------------------

7. $\begin{array}{r} 392 \\ \times 3 \\ \hline \end{array}$	8. $\begin{array}{r} 321 \\ \times 8 \\ \hline \end{array}$	9. $\begin{array}{r} 318 \\ \times 5 \\ \hline \end{array}$	10. $\begin{array}{r} 619 \\ \times 4 \\ \hline \end{array}$	11. $\begin{array}{r} 251 \\ \times 6 \\ \hline \end{array}$	12. $\begin{array}{r} 907 \\ \times 6 \\ \hline \end{array}$
-----------------------------------------------------------------------	-----------------------------------------------------------------------	-----------------------------------------------------------------------	------------------------------------------------------------------------	------------------------------------------------------------------------	------------------------------------------------------------------------

13. $\begin{array}{r} 452 \\ \times 7 \\ \hline \end{array}$	14. $\begin{array}{r} 947 \\ \times 7 \\ \hline \end{array}$	15. $\begin{array}{r} 540 \\ \times 8 \\ \hline \end{array}$	16. $\begin{array}{r} 768 \\ \times 8 \\ \hline \end{array}$	17. $\begin{array}{r} 342 \\ \times 9 \\ \hline \end{array}$	18. $\begin{array}{r} 876 \\ \times 9 \\ \hline \end{array}$
------------------------------------------------------------------------	------------------------------------------------------------------------	------------------------------------------------------------------------	------------------------------------------------------------------------	------------------------------------------------------------------------	------------------------------------------------------------------------

19. 6) <u>254</u>	20. 7) <u>295</u>	21. 8) <u>569</u>	22. 8) <u>899</u>	23. 7) <u>756</u>
24. 8) <u>177</u>	25. 8) <u>260</u>	26. 8) <u>365</u>	27. 8) <u>444</u>	28. 9) <u>288</u>

Multiply each number in the following columns as indicated :

29. By 2.	30. By 3.	31. By 4.	32. By 5.	33. By 6.	34. By 7.
a. 219	328	327	234	345	456
b. 470	167	476	567	678	789
c. 658	594	685	893	923	567
d. 573	835	891	456	456	890
e. 987	769	876	789	789	678

35. Multiply each number in example 34 by 8.

36. Multiply each number in example 34 by 9.

37. Divide 976, 1065, 768, 1195, 999, by 2.

38. Divide each number in example 37 by 4.

39. Divide each number in example 37 by 8.

40. Divide 974, 865, 828, 663, 579, by 3.

41. Divide each number in example 40 by 6.

42. Divide each number in example 40 by 9.

43. Divide 785, 1196, 947, 1328, 984, by 5.

44. Divide each number in example 43 by 7.

45. By working 9 hours a day a man can do a piece of work in 136 days. How many days will it take him if he works 1 hour a day? 8 hours a day?

46. At \$6.72 a week for board, what is the cost of 7 weeks' board? What is the cost of 1 day's board?

47. A father left \$8420 to be equally divided among his 2 sons and 3 daughters, what was the share of each child? Of the 3 daughters?

Some Weights and Measures in Common Use.**31. LIQUID MEASURE.**

4 gills (gi.) = 1 pint (pt.).
 2 pints = 1 quart (qt.).
 4 quarts = 1 gallon (gal.).

32. DRY MEASURE.

2 pints = 1 quart (qt.).
 8 quarts = 1 peck (pk.).
 4 pecks = 1 bushel (bu.).

33. NUMBERS.

12 ones = 1 dozen (doz.).
 12 dozen = 1 gross.
 12 gross = 1 great gross.
 20 ones = 1 score.

34. PAPER.

24 sheets = 1 quire.
 20 quires = 1 ream.
 2 reams = 1 bundle.
 5 bundles = 1 bale.

35. AVOIRDUPOIS WEIGHT.*Common Weights.*

16 ounces (oz.) = 1 pound (lb.).
 2000 pounds = 1 ton (T.).

Gross Weights.

112 pounds = 1 hundred weight (cwt.).
 20 cwt. (2240 lb.) = 1 long ton.

NOTE 1.—In weighing some articles, as iron and coal at the mines, and goods on which duties are paid at the United States custom houses, the long ton of 2240 lb. is used; when the kind of ton is not given, the common ton of 2000 lb. is understood.

36. Oral Exercises.

1. Repeat the table of liquid measure; of dry measure; of numbers; of paper; of common weights. How many pounds make a long ton?
2. Change 2 gal. 2 qt. to quarts; to pints; to gills.
3. At seven cents a quart for milk, how much must be paid for 2 gal. 3 qt.? for 5 gal.?
4. In a bushel there are how many quarts? how many pints?

5. At 10 cents a quart for tomatoes, how much money will pay for 2 pk. 3 qt.? for $\frac{1}{2}$ pk.? for $\frac{1}{2}$ bu.?

6. John bought $7\frac{1}{2}$ dozen oranges. How many oranges did he buy? At 2 cents apiece, how much did they cost?

7. How many pencils are there in a gross of pencils? in $\frac{1}{2}$ of a gross?

8. Eva's grandfather is 3 score and 5 years old. In how many years will he be 4 score years old?

9. How many sheets of paper are there in a quire? in a ream?

10. How many $\frac{1}{2}$ -ounce packages can be made from 1 lb. of nasturtium seeds?

11. If I buy 2 bunches of asparagus at 15 cents a bunch, 3 qt. of new potatoes at 12 cents a quart, and some radishes for 5 cents, how many cents must I pay for all?

12. Out of a 1-dollar bill make the change for 4 yards of silk braid at 12 cents a yard.

A traveler bought for his breakfast, 2 sandwiches at 8 cents apiece, coffee for 5 cents, 2 oranges at 3 cents apiece, and doughnuts for 10 cents. For his dinner he had chops, 40 cents; pie, 10 cents; 2 pears, at 4 cents each; and tea, 10 cents:

13. How much did his breakfast cost?

14. How much did his dinner cost?

15. How much more did his dinner cost than his breakfast?

16. How much did both breakfast and dinner cost?

17. How much change should he receive if he gave in payment, for his breakfast and dinner, a 1-dollar bill and a half-dollar.

37. Miscellaneous Examples for Written Work.

1. A barber shaved 28 persons on Monday, 23 on Tuesday, 24 on Wednesday, 31 on Thursday, 33 on Friday, and 45 on Saturday. How many did he shave in the 6 days?

2. After a collection was taken at a meeting, one box contained \$35.54, another \$27.48, another \$9.84, and another \$17.35. How much did all contain?

3. How many times does the hammer of a common clock strike in a day?

4. The Venetian clock strikes the number of each hour of the day from 1 to 24. How many strokes does it make in a day?

5. A train of cars took 624 passengers into St. Paul and brought back only 348. How many more passengers were taken into St. Paul than were brought back?

6. How many panes of glass are there in a block of houses that has 96 windows of 4 panes each, 86 windows of 6 panes each, and 24 windows of 3 panes each?

7. If 1 sparrow destroys 235 caterpillars in a day, how many will 6 sparrows destroy in a week?

8. In an orchard of 548 trees the owner set out 159 more, of which 72 died. How many remained alive?

9. A boy bought a writing desk for \$4.25 and a jack knife for \$1.37. He spoiled his jack knife in mending his desk, and then sold the desk for \$5.42. Did he gain or lose, and how much?

10. A dealer bought 4 bushels of potatoes for \$2.56 and sold them at 95¢ a bushel. How much did he gain?

11. A grocer paid \$5 for a box of 294 oranges; 127 of the oranges were spoiled; and he sold the remainder at 4¢ apiece. How much did he gain or lose?

38. To find a given part of a number.

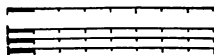
Illustrative Example. — If 8 equal dress patterns were cut from 67 yards of cloth, how many yards were there in each pattern?

WRITTEN WORK.

$$\begin{array}{r} 8 \overline{)67} \\ 8\frac{3}{8} \end{array}$$

Since 8 patterns were cut from 67 yards, in one pattern there was $\frac{1}{8}$ of 67 yards, which is 8 yards with a remainder of 3 yards. One-eighth of 3 yards is $\frac{3}{8}$ of 1 yard.

$\frac{1}{8}$ of 1 is $\frac{1}{8}$.
 $\frac{1}{8}$ of 3 is $\frac{3}{8}$.



Ans. $8\frac{3}{8}$ yards.

In performing the following examples divide the remainder, and express the answer as in the illustrative example above.

39. Examples for Written Work.

Divide

- | | |
|----------------------------------|----------------------------------|
| 1. \$1000 into 7 equal parts. | 6. Find $\frac{1}{2}$ of 4375. |
| 2. \$3297 into 8 equal parts. | 7. Find $\frac{1}{3}$ of 4375. |
| 3. \$4542 into 9 equal parts. | 8. Find $\frac{1}{4}$ of 4375. |
| 4. 4125 acres into 6 equal lots. | 9. Find $\frac{1}{10}$ of 3762. |
| 5. \$6321 among 5 persons. | 10. Find $\frac{1}{12}$ of 8559. |

11.
 $9 \overline{)7234}$

12.
 $9 \overline{)1928}$

13.
 $9 \overline{)1234}$

14.
 $9 \overline{)7361}$

$8 \overline{)5187}$

$9 \overline{)1904}$

$10 \overline{)8761}$

$10 \overline{)3205}$

Find the average

15. Per day, if 6 days' sales amount to \$875.
16. Per horse, if 5 horses are sold for \$802.
17. Per person, if a family of 7 spends \$1535 a year.
18. Mr. Elwell bought land for \$7648 and paid for $\frac{1}{3}$ of it every year till it was paid for. How much did he pay a year?

40. TIME MEASURE.

60 seconds (sec.)	= 1 minute (m.).
60 minutes	= 1 hour (h.).
24 hours	= 1 day (d.).
7 days	= 1 week (w.).
365 days, or 52 weeks 1 day	} = 1 common year.
366 days	= 1 leap year.
100 years	= 1 century.

41. Oral Exercises.

1. Repeat the table of time.

NOTE.—The word “day” as used in the table denotes the time from one midnight to the next. As used in the following examples, it denotes the time between sunrise and sunset.

2. How long is the night when the day is 9 hours long? when the day is 13 hours long?

3. When the sun rises at 5 o'clock and sets at 7 how long is the day? How long is the night?

4. How many seconds are there in 5 minutes?

42. There are 12 months in the year, with days as follows :

“Thirty days have September,
April, June, and November;
All the rest have thirty-one,
Except the second month alone,
To which we twenty-eight assign,
Till leap year gives it twenty-nine.”

5. January is the first month of the year. Name the months that make the first quarter of the year. Name the months of the second quarter. Of the third quarter. Of the fourth.

6. In a common year how many days are there in the first quarter? in the second? in the third? in the fourth?

43. LONG MEASURE.

12 inches (in.)	= 1 foot (ft.).
3 feet	= 1 yard (yd.).
5½ yards or 16½ feet	= 1 rod (rd.).
320 rods, or 5280 feet	= 1 mile (m.).

44. Oral Exercises.

1. Repeat the table of long measure.
2. How many inches are there in a yard? in half a yard? in a quarter of a yard? in an eighth of a yard?
3. What is the cost of 10 feet of molding at 15 cents a yard?
4. Dora is 3 feet 6 inches in height. What is her height in inches?
5. Richard measures 27 inches around his waist. What is this in feet and inches?
6. Carl sells berries at 9 cents a quart. How many quarts must he sell to get money enough to buy a hat worth 70 cents and a slate worth 11 cents?
7. If 5 dozen marbles are divided equally among 6 boys, how many does each boy receive?
8. How much will 9 quarts of cherries cost at 8 cents a quart?
9. How many pounds of beef at 12 cents a pound will be required to pay for the above cherries?
10. How many yards of gingham at 8 cents a yard can be bought for 3 dozen eggs at 20 cents a dozen?

SOLUTION.—3 dozen eggs at 20 cents a dozen will cost 3 times 20 cents. As many yards of gingham at 8 cents a yard can be bought for 60 cents as 8 is contained times in 60. *Ans.* 7½ yards.

11. If 4 men can do a piece of work in 9 days, in how many days can one man do it? In how many days can 6 men do the same work?

45. Miscellaneous Examples for Written Work.

1. A grain dealer bought flour for \$450, oats for \$125, and corn for \$214; he sold the whole for \$928. How much did he gain?

2. A lady bought some silk for \$33.75, some trimmings for \$8.38, and a shawl for \$14.50, and had \$8.87 left. How much money did she have at first?

3. The Revolutionary war began in 1775, and the Civil war in 1861. How many years were there between these two events?

4. A lease for 999 years expired in England in 1887. In what year was the lease given?

5. A farmer bought a wagon for \$76, and a carriage for twice as much. How much did he pay for both?

6. In the first grade of a school there were 268 pupils, in the second 213, in the third 162, in the fourth 112, and in the fifth 84. How many pupils were there in all? What was the average number to a grade?

7. In a certain school the attendance was Monday 160, Tuesday 154, Wednesday 164, Thursday 148, and Friday 159. What was the average daily attendance?

8. If a family consume 2 quarts of milk a day, how many quarts will they consume from Oct. 1 to Apr. 1, and what will they cost at 7¢ a quart? What will their milk cost for the rest of the year at 6¢ a quart?

9. Mr. Smith's income is \$2450 a year, and his expenses are \$1645 for the same time. At this rate, how much can he save in 1 year? In 8 years?

10. A miller owes a bill of \$521. If he pays \$388 in money and the balance in flour worth \$7 a barrel, how many barrels does it take?

11. Between A and B, 54 miles apart, there are 3 lines of telegraphic wire, and between B and C, 37 miles further on, there are 4 lines. How many miles of wire are there in all?

12. Brooklyn Bridge is 1 mile 709 feet long. What is its length in feet?

13. How much will 3 pieces of cotton cloth cost, if each piece contains 42 yards, at 9 cents a yard?

14. Here is a boy's account of what he had and what he spent last May. How much has he left?

		\$	¢
May 1	On hand from last month	2	54
"	Received from father	3	00
" 4	For doing an errand for Mr. Sage. . . . .	..	10
" 27	For weeding for Mrs. Otis, 4 hours . . . . .	..	..
	@ 12 ¢		
" 29	Mother gave me . . . . .	..	50
	Amount . . . . .	..	..
May 3	Spent for caps, 75¢; for paper, 17¢ . . . . .	..	..
" 6	Gave Mrs. Pitt, 40¢; bought ball, 25¢ . . . . .	..	..
" 8	Paid for square of glass, 40¢; for ride, 5¢ . . . . .	..	..
" 15	Birthday present for Mollie, 50¢ . . . . .	..	..
" 25	Shoes, \$1.25; hoe, 40¢; rattle for Dick, 7¢ . . . . .	..	..
	Amount . . . . .	..	..
Balance on hand May 31, \$			

15. A man who has \$86.00 owes \$21.07 to one person and \$36.48 to another. How much will he have left after paying these debts?

16. A cart was bought for \$46.50, there was spent \$3.80 for repairing it, and then it was sold for \$48.50. How much was gained or lost on it?

17. Two girls start from the same place to row. One goes east 298 feet, and the other west 284 feet. How far apart are they then?

18. If when the two girls are 582 feet apart they should row toward each other, one 135 feet and the other 178 feet, how far apart would they then be?

19. Mr. Smith lent a neighbor \$200. The neighbor paid at one time \$65.61, at another \$58.12, at another \$37.87, and at another gave toward payment a sheep worth \$9.40. How much of the debt did he then owe?

20. How many days are there in four years, one of them being a leap year?

21. I sent a telegram of 29 words, paying 25 cents for the first 10 words and 2 cents for each additional word. How much did the telegram cost?

22. The daily wages of 3 men were as follows: A's, \$3.50; B's, \$2.75; C's, \$1.80. What is the average of their daily wages?

23. If a blacksmith puts 8 nails in each horseshoe, and has used 2368 nails, how many shoes has he set? How many horses has he shod, each horse being shod all round?

24. Dana can walk around a pond in 9 minutes, and Henry can walk around it in 8 minutes. How many times can Dana walk around it while Henry walks around it 36 times?

25. Find the amount of the following bill :

Buffalo, Oct. 7, 1898.

Mr. George Wheeler

Bought of C. H. Hovey & Co.

5 yards velvet.....	@ \$.50	\$
4 pieces braid.....	" .25	
2 silk umbrellas.....	" 5.50	
8 napkin rings.....	" .38	
1 valise, \$4.25; 1 tie, \$1.35.....		
1 reticule, \$3.25; gloves, \$.62.....		
2 dozen pairs socks.....	" .63	

Received payment, \$

C. H. Hovey & Co.

26. As Mark rode in his dog cart he watched one of the wheels and found it turned 745 times in going from his home to his cousin's. The wheel measured 12 feet around. How many feet was it to his cousin's? How much more was it than a mile?

27. Mr. Brown had 5736 square feet of land and bought $\frac{1}{2}$ as much more. How much did he then have?

28. A clothier bought 12 coats for \$13.92 and sold them for \$1.50 apiece. How much did he gain on the lot?

29. America was discovered by Columbus in 1492; Plymouth was settled 128 years later, and the independence of the United States was declared 156 years later still. In what year was independence declared?

PART III.

NUMBERS WITHOUT LIMIT.

NOTATION AND NUMERATION.

46. One, ten, a hundred, a thousand are called **units**, because each is used like a single thing, in reckoning other numbers. Ones are called **units of the first order**; tens, **units of the second order**; hundreds, **units of the third order**; and so on. Numbers are expressed by the figures

1	2	3	4	5	6	7	8	9
One	Two	Three	Four	Five	Six	Seven	Eight	Nine

NOTE.—These figures are called significant figures to distinguish them from the zero, 0, which is used merely to fill an otherwise vacant place.

47. Figures written in the second place from the right represent tens, thus : 10, 20, 30, 40, 50, 60, 70; written in the third place, they represent hundreds, thus: 100, 200, 300, 400, 500, 600, 700, 800, 900; written in the fourth place, they represent thousands, thus : 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000.

48. The above illustrations show that *The value represented by a figure is made ten times as great by the removal of the figure one place to the left, and 1 tenth as great by its removal one place to the right.*

49. Ones, tens, and hundreds together form a **group**, which is read as units. Thus, 9 hundreds, 5 tens, 3 ones, are read together, 953 (units).

Thousands, tens of thousands, and hundreds of thousands form another group which is read as thousands.

As 10 hundreds make a thousand, so 10 hundred-thousands make a million, 10 hundred-millions make a billion, and so on.

50. The manner of writing numbers by figures is shown in the following

TABLE.										
etc.	Hundred-millions.	Ten-millions.	Millions.	Hundred-thousands.	Ten-thousands.	Thousands.	Hundreds.	Tens.	Units.	NAMES OF UNITS.
	9th.	8th.	7th.	6th.	5th.	4th.	3d.	2d.	1st.	PLACES.
	7	2	5	3	2	8	7	8	3	FIGURES.
	{			{			{			
	3d group.			2d group.			1st group.			{ GROUPS.
etc.	Millions.			Thousands.			Units.			

52. Illustrative Example.—Read the number 329475.

Beginning at the right, separate the figures into groups of three figures each by a comma; thus,
329,475.

Beginning at the left, name the numbers expressed by each group thus: *Three hundred twenty-nine thousand, four hundred seventy-five.*

NOTE. — The name of the units' group is usually omitted in reading.

53. Read the following :

8. 5,112	15. 438,611	22. 407,086
9. 6,307	16. 507,500	23. 196,080
10. 7,028	17. 70,862	24. 47,392
11. 63,426	18. 75,060	25. 1,216,432
12. 27,810	19. 906,224	26. 5,868,462
13. 16,707	20. 375,467	27. 270,537
14. 56,480	21. 5,879	28. 27,064,083

54. Write in figures :

- 29.** Four thousand four hundred fifty-six.
- 30.** Twenty-six thousand five hundred fifty-seven.
- 31.** Seventeen thousand twenty-one.
- 32.** Fifty-four thousand seven hundred six.
- 33.** Twenty thousand eight hundred seventy.
- 34.** Seventy thousand sixty-five.
- 35.** Six hundred ten thousand eighty.
- 36.** Two hundred three thousand seven hundred eight.
- 37.** Three hundred ninety thousand eight hundred ten.
- 38.** One million one hundred thirty thousand nine hundred nine.
- 39.** Thirty million seven hundred thousand.
- 40.** Sixteen million fifty thousand four hundred two.

Roman Notation.

55. Letters are sometimes used to number chapters, lessons, and exercises. This method of numbering is the old **Roman method**.

56. By this method seven letters are used, as follows :

I.	V.	X.	L.	C.	D.	M.
<i>One.</i>	<i>Five.</i>	<i>Ten.</i>	<i>Fifty.</i>	<i>One hundred.</i>	<i>Five hundred.</i>	<i>One thousand.</i>

By putting two or more of these letters together, any number may be represented.

57. *When a letter is written after another which expresses equal or greater value, the sum of the values is represented.* Thus, II. means one and one, or two; and VI. means five and one, or six.

When a letter is written before another which expresses greater value, the difference of the values is represented. Thus, IV. means 1 from 5, or 4; and IX. means 1 from 10, or 9.

58.

I. stands for 1	XI. stands for 11	XXI. stands for 21
II. " " 2	XII. " " 12	XXII. " " 22
III. " " 3	XIII. " " 13	XXIII. " " 23
IV. " " 4	XIV. " " 14	XXIV. " " 24
V. " " 5	XV. " " 15	XXV. " " 25
VI. " " 6	XVI. " " 16	XXVI. " " 26
VII. " " 7	XVII. " " 17	XXVII. " " 27
VIII. " " 8	XVIII. " " 18	XXVIII. " " 28
IX. " " 9	XIX. " " 19	XXIX. " " 29
X. " " 10	XX. " " 20	XXX. " " 30

59. Exercises for Written Work.

1. Write the letters that stand for 1, 5, 10, 50, 100, 500, 1000. Write the letters that stand for 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

60. 2. Read the following :

I.	XI.	XXI.	IV.	XIV.	XXXIV.
II.	XII.	XXII.	VII.	XVII.	XXXVII.
V.	XV.	XXV.	III.	XIII.	XXXIII.
VI.	XVI.	XXVI.	VIII.	XVIII.	XXXVIII.

61. 3. Write the letters that stand for the numbers from ten to twenty.

4. Write the letters that stand for the numbers from twenty to thirty.

5. Write the letters that stand for the numbers from thirty to thirty-nine.

6. Write the letters that stand for 8, 11, 14, 26, 29.

7. Write the letters that stand for 9, 16, 19, 35, 38.

62.

XL. stands for 40	CD. stands for 400
L. " " 50	D. " " 500
LX. " " 60	DC. " " 600
LXX. " " 70	DCC. " " 700
LXXX. " " 80	DCCC. " " 800
XC. " " 90	CM. " " 900
C. " " 100	MDCCCXCV. " " 1895
CC. " " 200	MCM. " " 1900
CCC. " " 300	MM. " " 2000

63. 8. Write the letters that stand for the numbers.

9. From forty to fifty.

10. From fifty to sixty.

11. From sixty to seventy.

12. From seventy to eighty.

13. From eighty to ninety.

14. From ninety to one hundred.

15. Write the letters that stand for 42, 53, 67, 75.

16. Write the letters that stand for 84, 88, 90, 96,

17. Write by letters the number of the present year.

ADDITION.

64. Addition is the process of putting two or more numbers together to find their sum or amount (pages 10 and 81).

65. Illustrative Example. Add \$546, \$963, \$95, and \$472.

WRITTEN WORK.

Addends, $\left\{ \begin{array}{l} 546 \\ 963 \\ 95 \\ 472 \end{array} \right.$

Sum, 2076

The numbers are written so that units of the same order are expressed in the same column, and a line is drawn beneath.

The adding begins with the units of the lowest order, and is from below upwards (thus, 2, 7, 10, 16), 16 units = 1 ten and 6 units. The 6 is written in the units' place, and the 1 ten is kept to add with the tens. Adding the tens (thus, 1, 8, 17, 23, 27), there are 27 tens = 2 hundreds and 7 tens. 7 is written in the tens' place, and the 2 hundreds are kept to add with the hundreds. Adding next the hundreds, the sum of all the numbers is 2076.
Ans. \$2076.

66. Keeping a number to add with the numbers expressed in the next column is **carrying**.

67. To **prove** the work in addition: *Repeat the work, adding downward instead of upward.*

68. The sign of addition is an upright cross, +. It is read "and" or "plus." The sign = indicates equality, and is read "equals" or "is equal to." Thus, $4+3+3=10$ means that 4 and 3 and 3 are 10. It is read "4 plus 3 plus 3 equals 10."

69. Examples for Written Work.

1. Find the sum of \$974, \$647, \$47.09, \$533, \$413, \$5.60, \$17.20, and \$8.19.

2. Find the weight of 6 bales of jute, weighing respectively, 536 pounds, 519 pounds, 507 pounds, 498 pounds, 486 pounds, and 467 pounds.

3. A man bought 4 loads of coal. The first weighed 3450 pounds, the second 4120 pounds, the third 3125 pounds, and the fourth 4280 pounds. How much did the whole weigh?

4. Add two million twenty thousand two, fourteen thousand ten, one million one thousand one, three million five thousand forty, seventy-six thousand four.

5. Add one million one thousand one hundred to one hundred million one hundred thousand ten.

6. Add three million four hundred thousand forty, fifty-five thousand six, two hundred sixty-two thousand fourteen, one hundred one, two hundred thousand nine.

7. Add one million two hundred, ten thousand one hundred thirteen, five thousand four, eight thousand seventy-eight, five hundred thousand two.

8. The area of New England is 66,465 square miles; of New York, 49,170 square miles; of Pennsylvania, 45,215 square miles; and of Texas, 104,930 more square miles than in all these. What is the area of Texas?

9. A merchant bought a quantity of cotton in New Orleans for \$5750, and sent it to New York. The freight cost \$529, cartage \$67, storage \$280, and insurance \$68.85. For how much must he sell the cotton to gain \$800?

10. $47,870 + 9087 + 764 + 99 + 10,243 + 17,000 = ?$

11. $7682 + 498 + 7709 + 4301 + 8007 + 90,900 = ?$

12. $2479 + 15,720 + 3908 + 199 + 8 + 250 + 87,654 = ?$

13. $\$220.63 + \$809.96 + \$4970.85 + \$607.50 + \$887.88 = ?$

14. Find the total estimate of loss by fire upon a block of stores as follows :

Floors	\$47.00	\$50.00	\$85.50
Sheathing	36.00	48.75	67.50
Plastering	18.60	25.50	36.75
Painting and glazing	47.80	68.90	75.00

15. How many square miles of land are there in the world, estimating the area of the continents as follows?

North America	9,349,741	Asia . .	16,956,284
South America	6,887,794	Africa .	11,514,985
Europe . . .	3,942,530	Oceanica	3,709,781

Add the following by columns and by lines, keep the answers of each addition and find their sum :

16.		17.		18.		19.
20. 363	+	247	+	1036	+	46=?
21. 407	+	621	+	908	+	900=?
22. 98	+	72	+	1684	+	267=?
23. 536	+	63	+	99	+	768=?
24. <u>647</u>	+	<u>975</u>	+	<u>423</u>	+	<u>419=?</u>
25. ?	+	?	+	?	+	? =?

Add the following in columns and in lines :

26.		27.		28.		29.
30. \$15.78	+	\$50.64	+	\$ 4.63	+	\$579.80=?
31. 4.63	+	2.22	+	80.67	+	66.67=?
32. 50.38	+	18.05	+	9.10	+	112.13=?
33. 0.27	+	44.65	+	70.00	+	9.97=?
34. 20.34	+	49.17	+	83.83	+	745.82=?
35. <u>1.50</u>	+	<u>0.78</u>	+	<u>1.00</u>	+	<u>530.00=?</u>
36. ?		?		?		? =?

SUBTRACTION.

70. Subtraction is the process of taking part of a number away to find how many are left. (Pages 11 and 82.)

71. Illustrative Example.—If \$3.25 is taken out of \$5, what sum will be left?

<p>WRITTEN WORK.</p> <p>Minuend, $\overset{(4)}{5}.\overset{(9)}{0}\overset{(10)}{0}$</p> <p>Subtrahend, 3.25</p> <p>Remainder, $\underline{1.75}$</p>	<p>The \$5 equals 500 cents, and the \$3.25 equals 325 cents.</p> <p>The numbers are written so that units of the same order are expressed in the same column, and a line is drawn beneath.</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

The subtracting begins with the units of the lowest order. As there are no units and no tens of cents in the minuend, one of the 5 hundreds is taken (leaving 4 hundreds) and changed to tens; one of the tens is taken (leaving 9 tens) and changed to units. 500 cents is thus changed to 4 hundreds, 9 tens and 10 units of cents, from which taking 325 cents, there remains 175 cents or \$1.75. *Ans.* \$1.75.

In practice simply think "5 from 10, 5"; "2 from 9, 7"; "3 from 4, 1"; and write the results.

72. To prove the work in subtraction: *Add together the remainder and subtrahend. Their sum should equal the minuend.*

73. The sign of subtraction is a horizontal line, —. It is read "minus" or "less." Thus the expression $10 - 7 = 3$ is read "10 minus 7 equals 3" or "10 less 7 equals 3."

74. Examples for Written Work.

1. Out of \$2500 owed for a farm \$1275 was paid. How much was still due?

2. The telescope was invented in 1608. How many years was this after printing was invented, which was in 1438?

3. How many years will it be from the time printing was invented to 1900?

4. The boarding of my horse is \$1 a day; with the shoeing it costs me \$400 a year. What is the cost of shoeing for the year 1897?

5. If a man earns \$1200 a year and spends \$936, how much will he have left at the end of the year?

6. A jockey bought three horses. The first cost \$175, the second \$80 less than the first, and the third \$67 less than the first. How much did they all cost?

7. A carriage was bought for \$300, a horse for \$160, and a harness for \$55. How much more was paid for the carriage than for the horse and harness together?

8. From the sum of 8759 and 6487 take their difference.

9. Mount Washington is 6288 feet high, and it is 2330 feet higher than Mount Vesuvius. How high is Mount Vesuvius?

10. How many years was it from the landing of Columbus in 1492 to the beginning of the Revolutionary war in 1775?

11. Add 5728 and 4354; from the sum take 9827, and to the result add 1748.

12. The shortest mail route from Washington, D.C. to Los Angeles is 2879 miles; from Washington to San Francisco is 3113 miles. How much farther is it to San Francisco than to Los Angeles?

13. In 1770 the area of Boston was 783 acres; in 1895 it was 23,700 acres. What was the increase in that time?

75. Examples in Addition and Subtraction.

14. A dealer in real estate bought a house for \$9500 and sold it for \$11,230. How much did he gain?

15. A man bought one house for \$5670, and another for \$6475. He spent \$580 for repairs and then sold them both for \$14,000. Did he gain or lose, and how much?

16. A man deposited in a bank at different times, \$350, \$475, and \$500; he drew out at one time \$275.50, and at another time \$50.50. How much remained in the bank?

17. In the year 1888 there were 125,170 male teachers in the United States and 212,558 female teachers. In the territories there were 3144 male, and 6420 female, teachers. How many male teachers were there in the states and territories? How many female? How many in all?

18. How many more female teachers than male were there in the states? in the territories? in both?

19. From 1888 to 1892 inclusive, the following number of immigrants were landed in the United States: in 1888, 546,889; in 1889, 444,427; in 1890, 455,302; in 1891, 560,319; in 1892, 623,084. How many immigrants were there in all?

20. How many more immigrants landed in 1892 than in 1891?

Subtract the following in columns and in lines :

	21.	22.		25.	26.
23.	\$3724.40	-\$2658.27	27.	\$2000.00	-\$735.12
24.	<u>\$1457.37</u>	<u>-\$ 982.75</u>	28.	<u>\$1903.08</u>	<u>-\$659.25</u>

MULTIPLICATION.

76. Multiplication is the process of uniting equal numbers to find their product. (Page 23, Ex. 3; page 96.)

77. The sign of multiplication is an oblique cross, \times . Thus, $4 \times 3 = 12$, means that three 4's are 12. It is read, "4 multiplied by 3 equals 12." It may also be read, "Three 4's equal 12," "3 times 4 equals 12."

78. Illustrative Examples.—How many combs are there (1) in 10 dozen combs? (2) in 20 dozen? (3) in 100 dozen? (4) in 200 dozen?

WRITTEN WORK.

(1)	(2)	(3)	(4)
12	12	12	12
<u>10</u>	<u>20</u>	<u>100</u>	<u>200</u>
120	240	1200	2400

In 1 dozen there are 12; in 10 dozen there are 10 times 12; in 20 dozen there are 20 times 12; in 100 dozen there are 100 times 12; and in 200 dozen there are 200 times 12.

To find the product when the multiplier is tens, hundreds, etc., multiply by the number of the tens, hundreds, etc., and annex to the product as many zeros as the multiplier has zeros.

79. Examples for Written Work.

1.	2.	3.	4.	5.	6.
25	25	42	48	73	125
<u>$\times 10$</u>	<u>$\times 20$</u>	<u>$\times 20$</u>	<u>$\times 30$</u>	<u>$\times 100$</u>	<u>$\times 200$</u>
250	500	840	1440	7300	25000
7.	8.	9.	10.	11.	12.
381	563	563	495	495	856
<u>$\times 300$</u>	<u>$\times 120$</u>	<u>$\times 1200$</u>	<u>$\times 900$</u>	<u>$\times 1000$</u>	<u>$\times 6000$</u>
114300	67560	675600	445500	495000	5136000

80. Illustrative Example. — Multiply 60 by 40.

$$\begin{array}{r} 60 \\ 40 \\ \hline 2400 \end{array}$$

When the multiplicand and multiplier, one or both, have zeros at the right, *disregard the zeros in multiplying, but annex to the product as many zeros as were disregarded.*

13.	14.	15.	16.	17.	18.
40	300	240	7600	480	200
$\times 50$	$\times 20$	$\times 30$	$\times 40$	$\times 500$	$\times 400$

19. In a cask of nails there are 100 pounds. How many pounds are there in 10 casks? in 30 casks?

How many

20. Months are there in 30 years? in 300 years?

21. Inches are there in 40 feet? in 400 feet?

22. Minutes are there in 1 hour? in 1 day?

23. How many seconds are there in 1 hour?

Find the cost

24. Of 400 dozen eggs at 25 cents a dozen.

25. Of 500 feet of boards at 16 cents a foot.

26. Of 40 acres of land at \$850 an acre.

Multiply and add the products :

27.

$$\begin{array}{l} 23 \times 2 = 46 \\ 23 \times 30 = 690 \\ \hline 23 \times 32 = ? \end{array}$$

28.

$$\begin{array}{l} 42 \times 4 = ? \\ 42 \times 50 = ? \\ \hline 42 \times 54 = ? \end{array}$$

29.

$$\begin{array}{l} 56 \times 3 = ? \\ 56 \times 20 = ? \\ \hline 56 \times 23 = ? \end{array}$$

30.

$$\begin{array}{l} 61 \times 5 = ? \\ 61 \times 50 = ? \\ \hline 61 \times 55 = ? \end{array}$$

31.

$$\begin{array}{l} 72 \times 6 = ? \\ 72 \times 50 = ? \\ \hline 72 \times 56 = ? \end{array}$$

32.

$$\begin{array}{l} 37 \times 4 = ? \\ 37 \times 70 = ? \\ \hline 37 \times 74 = ? \end{array}$$

33.

$$\begin{array}{l} 36 \times 3 = ? \\ 36 \times 40 = ? \\ \hline 36 \times 43 = ? \end{array}$$

34.

$$\begin{array}{l} 95 \times 7 = ? \\ 95 \times 80 = ? \\ \hline 95 \times 87 = ? \end{array}$$

35.

$$\begin{array}{l} 48 \times 9 = ? \\ 48 \times 60 = ? \\ \hline 48 \times 69 = ? \end{array}$$

81. Illustrative Example. — Multiply 29 by 34.

WRITTEN WORK.

$$\begin{array}{r} 29 \\ 34 \\ \hline 116 = \text{product by } 4 \\ 87 = \text{product by } 30 \\ \hline 986 = \text{product by } 34 \end{array}$$

To multiply by 34, first multiply by 4, then by 30, and add the products. In multiplying by 30, the product is 870, but there is no need of writing the zero, if we are careful to write the 87, which is tens, so that the 7 shall be under the 3 in the tens' place.

36. 37. If no mistake has been made in the work, the answers to examples 36 and 37 are equal. Hence

Multiply 46 35
by 35 46

82. To prove the work in multiplication, multiply the multiplier by the multiplicand. This product should equal the product first found.

83. Multiply and prove the following examples :

38.	39.	40.	41.	42.	43.
32	52	48	39	76	83
$\times 84$	$\times 37$	$\times 64$	$\times 25$	$\times 58$	$\times 89$

Multiply the following in lines and columns :

46.	47.	50.	51.	54.	55.	58.	59.
44. 67 × 79	48. 52 × 45	52. 94 × 79	56. 79 × 67				
45. 67 × 36	49. 68 × 25	53. 83 × 37	57. 94 × 89				
62.	63.	66.	67.	70.	71.	74.	75.
60. 25 × 56	64. 63 × 92	68. 58 × 45	72. 24 × 98				
61. 93 × 62	65. 47 × 25	69. 89 × 56	73. 67 × 74				

76. How many pounds of sweet potatoes are there in 18 bushels of 55 pounds each?

77. At \$14 a month, how much is earned in 1 year? in 18 months?

84. Illustrative Examples. — Multiply 227 by 145;
227 by 205.

WRITTEN WORK.

$$\begin{array}{r}
 227 \\
 145 \\
 \hline
 1135 = \text{product by } 5 \\
 908 = \text{product by } 40 \\
 227 = \text{product by } 100 \\
 \hline
 32915 = \text{product by } 145
 \end{array}$$

$$\begin{array}{r}
 227 \\
 205 \\
 \hline
 1135 = \text{product by } 5 \\
 454 = \text{product by } 200 \\
 \hline
 46535 = \text{product by } 205
 \end{array}$$

Multiply :

- 78.** 176 by 37. **81.** 49 by 128. **84.** 48 by 470.
79. 253 by 46. **82.** \$874 by 37. **85.** \$7.83 by 65.
80. 608 by 15. **83.** \$482 by 221. **86.** \$4.38 by 324.
87. How many are 691×18 ? **89.** $66 \times 409 = ?$
88. How many are $\$7.65 \times 312$? **90.** $\$9.82 \times 543 = ?$
91. I paid 17 laborers \$2.50 a day. What was the amount of their wages for a week?
92. There are 640 acres in a square mile. How many acres are there in a township of 36 square miles?
93. Change 15 days to hours; to minutes; to seconds.
94. A common clock strikes the hours only. How many strokes does it make in a year of 365 days?
95. Sound travels 1120 feet a second. How far off is a cannon the report of which is heard in 14 seconds?
96. How many square feet are there in a square-cornered lot of land which measures 324 feet in length and 268 feet in width?
97. Measure a rod in some convenient place, and pace it off. How many steps do you take in walking 1 rod? How many would you take in walking 320 rods, or 1 mile?

98. Mary earns \$1.62 every week. How much is that a year of 52 weeks?

99. How many seconds are there in the month of March?

100. At 56 pounds to a bushel, how many pounds of shelled corn are there in 4 bins which contain, severally, 36 bushels, 57 bushels, 29 bushels, and 68 bushels?

101. If 5 bushels of wheat of 60 pounds each are required to make a barrel of flour, how many pounds are required to make 150 barrels of flour?

Find the cost of :

102. 13 weeks' board at \$12.50 a week.

103. 25 cords of wood at \$8.25 a cord.

104. 250 pounds of halibut at 28¢ a pound.

Find the cost of a cablegram :

105. Of 5 words to Burmah at \$1.37 a word.

106. Of 12 words to Japan at \$2.21 a word.

107. Of 7 words to Siam at \$1.43 a word.

108. A seamstress who receives \$8.50 a week works the year round excepting 4 weeks. How much are her yearly wages?

109. The first House of Representatives of the United States consisted of 65 members. If each member represented 30,000 people, how many people were represented?

110. In a certain mill 139,300 yards of dress goods are made in a day. How much is that in 6 days?

111. If in one yard of cloth there are 590 fibers of warp and 452 of filling, and if each fiber of warp contains 32 strands and each fiber of filling 45 strands, how many strands are there in the yard?

DIVISION.

85. Division is the process of separating a number into equal parts. (Page 39, Ex. 6; page 97.)

Two Forms of Division, Measuring and Partitive.

86. Illustrative Example. — In a bushel of 32 quarts there are how many pecks of 8 quarts each?

Ans. 4 pecks.

WRITTEN WORK.

In this example 32 quarts is separated into a number of equal parts, the size of which is given, to find how many such parts there are. This is the **measuring** form of division.

$$\begin{array}{r} \text{Quarts } 8 \overline{)32} \text{ Quarts} \\ 4 \end{array}$$

Illustrative Example. — In a bushel of 32 quarts there are 4 pecks. How many quarts are there in 1 peck?

Ans. 8 quarts.

WRITTEN WORK.

In this example 32 quarts is separated into a given number of equal parts to find the size of one part. This is the **partitive** form of division.

$$\begin{array}{r} 4 \overline{)32} \text{ Quarts} \\ 8 \text{ Quarts} \end{array}$$

In which form do the dividend and divisor have the same denomination? In which form do the dividend and quotient have the same denomination?

87. The sign of division is a horizontal line with dots above and below, \div . Thus, $24 \div 8 = 3$ means and is read "24 divided by 8 equals 3." The partitive form of division is also denoted thus: $\frac{1}{2}$ of 16; $\frac{1}{4}$ of 32; $\frac{1}{10}$ of 60; $\frac{1}{100}$ of 500, etc. The expressions are read: "one half of 16," one fourth of 32," etc.

88. To **prove** the work in Division: *Find the product of the divisor and quotient, and add to this product the remainder, if there is one. The result should equal the dividend.*

Partitive Form of Division.

89. What is one of the equal parts called when a thing or number is divided into two equal parts? into three? four? ten? twenty? one hundred?

These parts are written thus :

One half, $\frac{1}{2}$; one third, $\frac{1}{3}$; one fourth, $\frac{1}{4}$.

One tenth, $\frac{1}{10}$; one twentieth, $\frac{1}{20}$; one hundredth, $\frac{1}{100}$.

90. Illustrative Example.—Divide \$ 200 equally among 3 persons.

WRITTEN WORK. Each person will have $\frac{1}{3}$ of \$200, which is found by dividing 200 by 3. *Ans.* \$66 $\frac{2}{3}$.

The explanation of the work may be the same as that given in the illustrative example on page 97, or it may be as follows:

$\frac{1}{3}$ of 20 tens is 6 tens, with a remainder of 2 tens. We write 6 for the tens of the quotient.

$\frac{1}{3}$ of 20 is 6, with a remainder of 2. We write 6 for the units of the quotient.

$\frac{1}{3}$ of 2 is $\frac{2}{3}$, which we write. *Ans.* 66 $\frac{2}{3}$.

In doing this work say simply, " $\frac{1}{3}$ of 20, 6"; "of 20, 6 $\frac{2}{3}$."

91. Examples for Written Work.

Find

1. $\frac{1}{2}$ of 435,076.
2. $\frac{1}{3}$ of 276,543.
3. $\frac{1}{4}$ of 758,000.
4. $\frac{1}{5}$ of 336,542.
5. $\frac{1}{6}$ of 143,864.
6. $\frac{1}{7}$ of 865,300.
7. $\frac{1}{8}$ of 180,067.

Find

8. $\frac{1}{3}$ of 2,468,035.
9. $\frac{1}{5}$ of 6,047,396.
10. $\frac{1}{4}$ of 3,807,624.
11. $\frac{1}{8}$ of 1,746,342.
12. $\frac{1}{7}$ of 9,763,052.
13. $\frac{1}{9}$ of 4,534,726.
14. $\frac{1}{9}$ of 1,863,142.

LONG DIVISION.

92. Illustrative Example. — How many bushels are there in 896 quarts ?

WRITTEN WORK. 1st form.

$$\begin{array}{r}
 28 \text{ Quotient} \\
 \text{Divisor } 32 \overline{)896} \text{ Dividend} \\
 \underline{64} \\
 256 \\
 \underline{256} \\
 0
 \end{array}$$

WRITTEN WORK. 2d form.

$$\begin{array}{r}
 \text{Dividend} \\
 \text{Divisor } 32 \overline{)896} (28 \text{ Quotient} \\
 \underline{64} \\
 256 \\
 \underline{256} \\
 0
 \end{array}$$

There are as many bushels in 896 quarts as there are times 32 in 896.

Divide first the 89 tens by 32. 89 tens divided by 32 equals 2 tens, which is written above the 9 in the tens' place (or at the right as in the second form). Multiplying 32 by 2 tens and subtracting the product from 89 tens, 25 tens remain. 25 tens with 6 units make 256.

256 divided by 32 equals 8, which is written in the units' place, giving for the quotient 28. *Ans.* 28 bushels.

93. When the divisor is greater than 12, as in the above example, it is convenient and generally necessary to write down the entire operation. When this is done, the division is called **long division**.

When the divisor is small, so that it is easy to divide without writing down the entire operation, the division is called **short division**.

94. Examples for Written Work.

- | | | |
|-----------------------|---------------------|----------------------|
| 15. Divide 805 by 23. | 19. $792 \div 22$? | 23. $744 \div 24$? |
| 16. Divide 805 by 35. | 20. $792 \div 36$? | 24. $1024 \div 32$? |
| 17. Divide 625 by 25. | 21. $918 \div 27$? | 25. $1064 \div 38$? |
| 18. Divide 858 by 33. | 22. $988 \div 38$? | 26. $3380 \div 65$? |

95. Illustrative Examples. — (1) Divide 18,986 by 62; (2) divide 20,023 by 49.

WRITTEN WORK.

$$\begin{array}{r}
 306\frac{1}{2}, \text{ Ans.} \\
 (1) \ 62 \overline{)18986} \\
 \underline{186} \\
 386 \\
 \underline{372} \\
 14
 \end{array}
 \qquad
 \begin{array}{r}
 (2) \ 49 \overline{)20023} \ (408\frac{1}{9}, \text{ Ans.} \\
 \underline{196} \\
 423 \\
 \underline{392} \\
 31
 \end{array}$$

In example (1), notice that $189 \div 62$ gives about the same quotient as $18 \div 6$. Using 6 as the trial divisor, the first term of the quotient is 3 (hundreds).

In example (2), notice that 49 is nearly 50, and that $200 \div 49$ gives about the same quotient as $20 \div 5$. Using 5 as the trial divisor, the first term of the quotient is 4 (hundreds).

- | | |
|---------------------------------|---------------------------------------|
| 27. Divide 3977 by 32. | Divide the following |
| 28. Divide 3224 by 93. | as indicated: |
| 29. Divide 1219 by 24. | 43. $72 \overline{)37,875}$. |
| 30. Divide 3322 by 54. | 44. $61 \overline{)18,430}$. |
| 31. Divide 1731 by 36. | 45. $27 \overline{)42,440}$. |
| 32. Divide 3977 by 76. | 46. $39 \overline{)37,075}$. |
| 33. Divide 3627 by 38. | 47. $46 \overline{)44,999}$. |
| 34. Divide 5983 by 47. | 48. $29 \overline{)60,000}$. |
| 35. Divide 47,380 by 32. | 49. $37 \overline{)81,063}$. |
| 36. Divide 90,147 by 43. | 50. $48 \overline{)75,166}$. |
| 37. Divide 32,203 by 93. | 51. $67 \overline{)48,899}$. |
| 38. Divide 14,608 by 45. | 52. $79 \overline{)72,416}$. |
| 39. Divide 33,000 by 51. | 53. $89 \overline{)154,720}$. |
| 40. Divide 25,132 by 63. | 54. $98 \overline{)370,800}$. |
| 41. Divide 21,423 by 71. | 55. $75 \overline{)52,224}$. |
| 42. Divide 92,345 by 69. | 56. $84 \overline{)876,543}$. |

96. To divide by 10, 100, 1000, etc.

2000 equals how many 10's? 100's? 1000's?

Illustrative Examples. — Divide 2001 by 10; by 100; by 1000.

WRITTEN WORK.

To divide a number by 10, 100, 1000, is to find how many 10's, 100's, or 1000's there are in the number.

2001 ÷ 10 = $200\frac{1}{10}$ = 200.1. The number of 10's in 2001 is shown, by cutting off the right hand figure, to be 200 with a remainder of 1. The quotient is $200\frac{1}{10}$.

2001 ÷ 100 = $20\frac{1}{100}$ = 20.01. The number of 100's in 2001 is shown, by cutting off the two right hand figures, to be 20 with a remainder of 1. The quotient is $20\frac{1}{100}$, and so on.

2001 ÷ 1000 = $2\frac{1}{1000}$ = 2.001.

The result, $200\frac{1}{10}$, is also expressed in the form 200.1, $20\frac{1}{100}$ in the form 20.01, and $2\frac{1}{1000}$ in the form 2.001. 0.1, 0.01, and 0.001 are called **decimal fractions**, and the dot is called the **decimal point**.

Divide each of the following numbers by 10, 100, and 1000, and express the quotients in both forms given above :

57. 25,003. **59.** 19,009. **61.** 24,015. **63.** 42,036.

58. 17,043. **60.** 76,063. **62.** 103,084. **64.** 17,675.

65. How many dollars are there in 5864 cents? in 34,875 cents?

66. How many piles, of 20 half-dollars each, can be made with 1548 half-dollars?

NOTE. — The 1548 can be divided by 10 and the result then divided by 2.

67. How many piles of money, each containing 40 quarters of a dollar, can be made with 48,620 quarters?

68. How many piles of 50 nickels each can be made with 73,218 nickels?

69. A man travels on a bicycle 275 miles in 6 days. How many miles is that a day?

70. If a man walks 25 miles in a day, how many days will it take him to walk 1000 miles?

71. There are 5280 feet in a mile. How many times must a wagon wheel turn in going a mile, if it is 15 feet round the rim?

72. The wheel of a trotting gig was 13 feet round the rim. How many times did it turn in going a mile and one half?

73. Mr. French planted 1296 hills of corn in rows of 27 hills each. How many rows did he plant?

74. If Mr. French had planted the same number of hills in 16 rows, how many hills would he have had in a row?

75. How many barrels can be filled with 2000 pounds of flour, each barrel containing 196 pounds?

76. A load of potatoes, weighing 1792 pounds, was to be put into bags of 2 bushels each. If each bushel weighed 60 pounds, how many bags were filled, and how many pounds remained?

77. How many bags will be required to hold 1792 pounds of corn, if 2 bushels of 56 pounds each are put into a bag?

78. A man bought an estate for \$14,600, agreeing to make yearly payments of \$1500 each. How many such payments must he make, and what is the amount of the last payment?

79. In order to walk a mile, how many times must I go around a block that is 300 ft. long and 228 ft. wide?

80. If the earth moves 1,641,600 miles in 24 hours, how many miles does it move in 1 hour? in 1 minute?

97. To divide one sum of money by another.

Illustrative Example. — At \$3.75 for boots, how many pairs of boots can be bought for \$80?

WRITTEN WORK.

$$375 \overline{)8000} (21 \text{ Quotient}$$

$$\underline{750}$$

$$500$$

$$\underline{375}$$

$$125$$

Ans. 21 pairs; \$1.25 rem.

To divide one sum of money by another, both dividend and divisor must be expressed in the same denomination. Here the divisor is cents, and so the dividend must be changed to cents. \$80 changed to cents equals 8000 cents, which divided by 375 cents gives 21 for a quotient, with a remainder of 125

cents. *Ans.* 21 pairs; \$1.25 remains.

81. A school was supplied with reading books for

82. At 35¢ each how many books were there?

83. At 18¢ a box for strawberries, how many boxes can be had for \$5?

84. At \$1.35 a yard for carpeting, how many yards can be bought for \$50? for \$85?

How many:

85. Grape vines at 42¢ each can be bought for \$10?

86. Pairs of gloves at \$1.25 a pair can be bought for \$18?

87. Hats at \$2.62 each can be bought for \$15?

88. Meals at 45¢ each can be had for \$28?

89. Acres of government land at \$1.25 an acre can be bought for \$250?

90. In 1817 it cost \$14 to carry a barrel of flour from Pittsburg to Philadelphia. At 18¢ a barrel, which is now the price, how many barrels of flour can be carried the same distance for \$14?

98. To divide a sum of money into parts, carrying the division to cents.

Illustrative Example.—If 5 boys are to share \$12 equally, how much will each boy have?

WRITTEN WORK.

$$\begin{array}{r} 5 \overline{) \$12.00} \\ \$2.40 \end{array}$$

Each boy will have $\frac{1}{5}$ of \$12. After dividing \$12 by 5 there is a remainder of \$2, which is changed to cents, and the division is continued, making the entire quotient \$2.40. *Ans.* \$2.40.

90. 12 men hired a barge for \$15. What was each man's share of the cost?

91. When 50 pounds of beef costs \$11, how much is it a pound?

92. What is 1 sixteenth of \$296?

93. What is 1 thirty-fifth of \$198.45?

94. When 36 acres of land cost \$414, how much does 1 acre cost?

99. Miscellaneous Examples for Written Work.

95. James shot an arrow 67 feet, and Fred shot one 39 feet farther on. How far must James go to pick up Fred's arrow and return to his starting place?

96. If Jane is 38 feet from you on the right, and Grace is 47 feet from you on the left, how far must Jane walk to go to Grace and back to you again?

97. Amy and Jane are at each end of a walk 204 feet in length. After Amy has walked 26 feet toward Jane, and Jane has walked 49 feet toward Amy, how far apart are they?

98. How far apart would Amy and Jane have been if they had walked away from each other?

99. A school room is 32 feet long. There are 4 windows on each side each 4 feet wide, and the rest of the distance is filled in with blackboards. How many feet are filled with blackboards?

100. The oldest church in England is St. Martin's, in Canterbury; it was built in 360 A.D. How old will it be in the year 1900?

101. A cow cost \$75, 2 horses cost \$375 each, and a hack as much as the cow and horses together. What was the cost of all?

102. It is estimated that to yield 1 pound of honey from clover, 62,000 heads of clover must be used. A bee colony in California makes an average of 70 pounds of honey. This would require how many heads of clover?

103. John earned \$11.25. With the money he bought a necktie for 28¢, 2 pairs of stockings at 18¢ a pair, and a hat for \$1.37. How much money had he left?

104. At 4 cents each for slats, what is the cost of slats to fence a lot of land having 2 sides of 362 feet in length and 2 sides of 288 feet in length, 5 slats being required for each foot of length?

105. A produce dealer bought 95 bushels of potatoes at 46 cents a bushel. How much did he pay for them? He sold 62 bushels at 75 cents a bushel, and the remainder at 56 cents a bushel. How much did he sell them for? How much did he gain by the transactions?

106. I bought 1420 barrels of flour at \$5 a barrel. I sold 580 barrels at \$6 a barrel, 435 barrels at \$6.50 a barrel, and the remainder at \$7.50 a barrel. How much did I gain?

107. A town of 83,200 acres is to be divided into 520 farms of equal size. What would be the value of one of these farms at \$45 an acre?

108. About 300,000 car loads of fruit and vegetables, valued at \$30,000,000, are shipped annually from the Southern States. What is the value per car load?

109. At 35 cents each, what will be the cost of ties to build a mile of railroad, there being 6 ties to a rod, and 320 rods in a mile?

110. It is about 25,000 miles around the earth. How many days would it take a person to travel this distance, if he traveled 40 miles a day?

111. The great bell at Moscow weighs 448,000 pounds. What is its weight in tons?

112. How many square miles are there in the United States, the North Atlantic States containing 168,665 square miles; the South Atlantic States, 282,535 square miles; the North Central States, 765,855 square miles; the South Central States, 588,890 square miles; the Western States, 1,187,535 square miles, and Alaska and other regions, 674,687 square miles.

113. A farmer bought 4590 feet of boards at 3 cents a foot and gave in payment cheese at 12 cents a pound. How many pounds did it take?

114. In one part of her orbit the moon is 224,000 miles from the earth. If a cannon-ball, moving at the rate of 16 miles a minute, should go this distance, in how many minutes would it make the passage?

115. In a brisk gale, air moves 2200 feet a minute. How many feet is that an hour? How many miles?

116. In a hurricane, air moves 7480 feet a minute. How many miles is that an hour?

100. DRILL TABLE. MULTIPLICATION AND DIVISION.

(See Teachers' Key.)

	<i>k</i>		<i>l</i>		<i>m</i>		<i>n</i>		<i>o</i>		<i>p</i>		<i>q</i>		<i>r</i>		<i>s</i>		<i>t</i>		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
<i>a</i>	2	3	2	4	2	6	5	8	4	8	6	8	7	7	9	9	9	7	9	8	<i>a</i>
<i>b</i>	1	2	1	4	1	3	5	5	4	2	5	2	5	3	6	9	4	1	7	8	<i>b</i>
<i>c</i>	2	2	2	1	3	4	5	6	4	1	5	3	7	3	7	4	8	3	8	8	<i>c</i>
<i>d</i>	1	5	1	6	2	5	1	7	3	5	2	9	2	5	3	7	2	4	5	9	<i>d</i>
<i>e</i>	2	1	2	3	3	3	5	4	4	0	9	0	6	3	3	1	7	1	8	3	<i>e</i>
<i>f</i>	1	3	1	6	1	5	4	5	1	7	8	4	2	8	2	7	5	4	6	7	<i>f</i>
<i>g</i>	2	2	2	4	3	0	6	0	5	1	8	2	7	2	9	5	8	1	8	0	<i>g</i>
<i>h</i>	1	4	1	8	2	8	4	9	1	9	3	4	4	7	1	9	4	6	7	6	<i>h</i>
<i>i</i>	2	5	2	1	2	7	6	2	4	4	9	1	6	6	7	5	8	7	9	6	<i>i</i>
<i>j</i>	1	1	1	8	1	9	1	8	2	6	6	4	3	9	5	6	5	8	4	8	<i>j</i>
							<i>u</i>				<i>v</i>				<i>w</i>						

Exercises on the Table.In each of the ten lines *a*, *b*, *c*, etc., multiply

- | | |
|-------------------------------|---------------------------------|
| 1-10. <i>u</i> by 6. | 61-70. $\$p, q\phi$ by 11. |
| 11-20. <i>v</i> by 8. | 71-80. $(k+l)$ by <i>m</i> . |
| 21-30. <i>w</i> by 9. | 81-90. $\$0.56$ by <i>u</i> . |
| 31-40. <i>w</i> by 12. | 91-100. $\$0.78$ by <i>w</i> . |
| 41-50. <i>n</i> by <i>o</i> . | 101-110. $\$9.02$ by <i>v</i> . |
| 51-60. $\$n, o\phi$ by 7. | 111-120. <i>u</i> by <i>v</i> . |

In each of the ten lines *a*, *b*, *c*, etc., divide

- | | |
|--------------------------|-------------------------------------|
| 121-130. <i>w</i> by 11. | 161-170. <i>u</i> by 857. |
| 131-140. <i>w</i> by 12. | 171-180. <i>v</i> by 689. |
| 141-150. <i>u</i> by 23. | 181-190. $v \times r$ by <i>s</i> . |
| 151-160. <i>u</i> by 41. | 191-200. $\$n, o\phi$ by $\$0.72$. |

FACTORS AND FACTORING.

101. Name two numbers which multiplied together make 6.

3×2 are 6, 2×3 are 6; $1 \times 6 = 6$, $6 \times 1 = 6$.

A number used either as multiplicand or multiplier to produce a number is a **factor** of the number. Thus, 3 and 2, also 6 and 1, are factors of 6.

Name two factors of 8; * of 9; of 10; of 12; of 15.

Name one of the two equal factors of 4; 9; 36; 25; 49; 64.

Name the factors of 2; 5; 7; 11; 13; 17; 19; 23.

102. A number that has no factors besides itself and 1 is a **prime** number.

103. A number that has other factors besides itself and 1 is a **composite** number.

104. Exercises for Oral or Written Work.

1. Among the following numbers, name those that are prime. Name those that are composite:

2; 6; 7; 8; 10; 11; 12; 13; 14; 15; 16; 17; 18.

2. Name any factor of 12 which is a prime number.

105. A factor that is a prime number is a **prime factor**.

3. Name the prime factors of 12. *Ans.* 2, 2, 3.

106. *Every composite number equals the product of all its prime factors.* Thus, $12 = 2 \times 2 \times 3$.

Separate into their prime factors :

4.	5.	6.	7.	8.	9.	10.
6	10	16	21	25	32	36
8	12	18	22	27	33	40
9	15	20	24	30	35	42

* One, which is a factor of every number and the number itself, need not be named.

Separate into their prime factors :

11.	12.	13.	14.	15.	16.	17.
45	50	56	66	80	90	108
48	54	60	70	81	96	120
49	55	63	72	84	100	144

107. Every number that contains 2 as a factor is an **even** number. All other numbers are **odd**.

108. Illustrative Example. — Find all the prime factors of 18 and 24.

The prime factors of 18 are **2, 3, and 3**.

The prime factors of 24 are **2, 2, 2, and 3**.

2 and 3 and their product 6 are factors of both 18 and 24.

Because these factors are found in both 18 and 24, they are **common factors** of 18 and 24; and because 6 is the greatest factor in both numbers, it is their **greatest common factor** (g. c. f.).

Notice that the g. c. f. of 18 and 24 is the product of all the prime factors that are common to 18 and 24.

109. Illustrative Example. — Find the greatest common factor of 24 and 40.

WRITTEN WORK. The factors that are common to 24 and 40 are 2, 2, and 2; and their product is 8. Hence 8 is the greatest common factor of 24 and 40.

Find mentally, or by writing, the greatest common factor of

18. 18 and 27. 20. 36 and 48. 22. 25, 50, and 80.
 19. 42 and 56. 21. 54 and 63. 23. 45, 72, and 81.

MULTIPLES.

110. Name some numbers which are made by using 2 as a factor. *Ans.* 2, 4, 6, 8, etc.

A number made by using another number as a factor is a **multiple** of the number so used. Thus, the numbers 2, 4, 6, 8, are multiples of 2.

111. Write the multiples of 3 and of 4 to 24.

Ans. { The multiples of 3 are 3, 6, 9, **12**, 15, 18, 21, **24**.
 { The multiples of 4 are 4, 8, **12**, 16, 20, **24**.

Which of these numbers are multiples of both 3 and 4?

A number that is a multiple of two or more numbers is a **common multiple** of these numbers. Thus 12 and 24 are both common multiples of 3 and 4.

Which of these numbers is the least multiple common to 3 and 4? This is called the **least common multiple** (l. c. m.) of the numbers.

112. Exercises for Oral or Written Work.

Name the least common multiple

1. Of 8 and 12; of 10 and 15; of 3, 9, and 4.
2. Of 2 and 5; of 5 and 7; of 5, 8, and 10.

113. Illustrative Example. — Find the least common multiple of 12, 4, and 9.

WRITTEN WORK.

$$12 = 2 \times 2 \times 3.$$

$$4 = 2 \times 2.$$

$$9 = 3 \times 3.$$

$$\text{l. c. m.} = 2 \times 2 \times 3 \times 3 = 36.$$

The least common multiple of these numbers is the least number that contains all their prime factors.

A multiple of 12 must contain 2, 2, and 3, which include the factors of 4 and one of the factors (3) of 9. Taking with these factors the other factor (3) of 9, we have $2 \times 2 \times 3 \times 3$, or 36, for the l. c. m. of 12, 4, and 9.

Find mentally or by written work the least common multiple :

- | | |
|---------------------|----------------------|
| 3. Of 4, 5, and 8. | 6. Of 8, 18, and 9. |
| 4. Of 6, 4, and 9. | 7. Of 12, 9, and 8. |
| 5. Of 7, 5, and 10. | 8. Of 16, 12, and 8. |

CANCELLATION.

114. Illustrative Examples. — (1) Multiply 5 by 4 and divide the product by 4. (2) Divide the product of 5 times 8 by 4.

WRITTEN WORK.

$$(1) \frac{5 \times \cancel{4}}{\cancel{4}} = 5.$$

(1) If any number, as 5 in example (1), is multiplied by a number and the product is divided by the same number, the two operations offset or **cancel** each other, and the result is the original number. Hence both operations may be omitted.

WRITTEN WORK.

$$(2) \frac{5 \times \overset{2}{\cancel{8}}}{\cancel{4}} = 10.$$

(2) Here 4 is a factor of both 8 and 4; it may therefore be struck out or **canceled**, leaving 5 to be multiplied by 2 only.

115. Cancellation is the process of striking out equal factors in dividend and divisor.

116. Examples for Written Work.

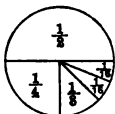
Divide :

- | | |
|-------------------------------------|-----------------------------------------------------------------------|
| 1. 7×12 by 6. | 8. 20×9 by 3×5 . |
| 2. 9×10 by 5. | 9. 9×6 by 12×3 . |
| 3. 9×10 by 3×5 . | 10. 16×10 by 5×8 . |
| 4. 6×15 by 2×5 . | 11. 25×14 by 35×2 . |
| 5. 12×5 by 10×3 . | 12. 45×45 by 75×2 . |
| 6. 28×6 by 7×2 . | 13. $\frac{121 \times \cancel{4} \times \cancel{6}}{22 \times 3} = ?$ |
| 7. 8×22 by 4×11 . | 14. $\frac{96 \times 7 \times 5}{14 \times 6 \times 10} = ?$ |

PART IV.

COMMON FRACTIONS.

117. When a unit is divided into two equal parts, what are the parts called? What are the parts called when a unit is divided into 4 equal parts? into 8 equal parts? into 16 equal parts?



A unit that is a whole or undivided thing, as a circle, is an **integral unit**.

One or more of the equal parts of a unit is a **fraction**.

118. The unit which is divided into equal parts to make a fraction is called the **unit of the fraction**.

119. The number of equal parts into which the unit of the fraction is divided is the **denominator** of the fraction. The number of parts taken is the **numerator** of the fraction. The numerator and denominator are the **terms** of the fraction.

In three fourths of an apple, what is the unit of the fraction? what is the numerator? the denominator?

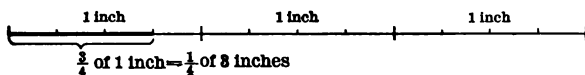
120. To write fractions.

Fractions are written, the numerator above and the denominator below a dividing line, thus,

$$\left. \begin{array}{l} \frac{3}{4} \text{ Numerator} \\ \text{Denominator} \end{array} \right\} \text{Terms.}$$

When written in this form, the fractions are called **common fractions**.

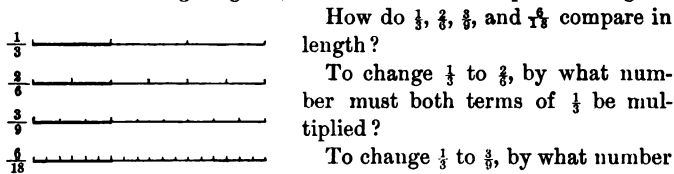
The expression $\frac{3}{4}$ may mean $\frac{3}{4}$ of 1 or $\frac{1}{4}$ of 3. The two quantities are equal, as may be seen by the following illustration :



Show by a diagram that $\frac{1}{3}$ of 2 = $\frac{2}{3}$ of 1 ; that $\frac{1}{3}$ of 3 = $\frac{3}{3}$ of 1.

121. To change a fraction to larger terms.

In the following diagram, how do the lines compare in length?



By what number must both terms of $\frac{1}{3}$ be multiplied to change it to $\frac{6}{18}$?

When the fraction $\frac{1}{3}$ is changed to $\frac{2}{6}$, what change is made in the size of the parts? In the number of parts taken?

A fraction can be changed to larger terms by multiplying both terms by the same number.

122. Oral and Sight Exercises.

Read and supply the missing numerators :

- $\frac{1}{2} = \frac{\quad}{4} = \frac{\quad}{6} = \frac{\quad}{8} = \frac{\quad}{10} = \frac{\quad}{12} = \frac{\quad}{14} = \frac{\quad}{16} = \frac{\quad}{20}$.
- $\frac{1}{3} = \frac{\quad}{6} = \frac{\quad}{9} = \frac{\quad}{12} = \frac{\quad}{18} = \frac{\quad}{24} = \frac{\quad}{30} = \frac{\quad}{36} = \frac{\quad}{27}$.
- $\frac{1}{5} = \frac{\quad}{10} = \frac{\quad}{15} = \frac{\quad}{25} = \frac{\quad}{35} = \frac{\quad}{50} = \frac{\quad}{60} = \frac{\quad}{75}$.
- $\frac{2}{3} = \frac{\quad}{6} = \frac{\quad}{9} = \frac{\quad}{15} = \frac{\quad}{21} = \frac{\quad}{24} = \frac{\quad}{30} = \frac{\quad}{33} = \frac{\quad}{36}$.
- $\frac{3}{4} = \frac{\quad}{8} = \frac{\quad}{12} = \frac{\quad}{16} = \frac{\quad}{40} = \frac{\quad}{48} = \frac{\quad}{100} = \frac{\quad}{80} = \frac{\quad}{60}$.

Change	Change
6. $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{6}, \frac{5}{6}$ to 12ths.	13. $\frac{1}{5}, \frac{3}{8}, \frac{3}{10}, \frac{9}{10}$ to 40ths.
7. $\frac{1}{2}, \frac{1}{4}, \frac{3}{8}, \frac{5}{8}, \frac{3}{4}$ to 16ths.	14. $\frac{1}{10}, \frac{5}{6}, \frac{4}{5}, \frac{5}{12}$ to 60ths.
8. $\frac{1}{2}, \frac{1}{4}, \frac{1}{5}, \frac{3}{10}, \frac{7}{10}$ to 20ths.	15. $\frac{1}{6}, \frac{5}{8}, \frac{1}{7}, \frac{3}{7}$ to 42ds.
9. $1, \frac{2}{3}, \frac{3}{8}, \frac{1}{6}, \frac{5}{6}$ to 24ths.	16. $\frac{1}{8}, \frac{3}{8}, \frac{1}{7}, \frac{6}{7}$ to 56ths.
10. $\frac{1}{3}, \frac{3}{5}, \frac{2}{5}, \frac{5}{6}, \frac{7}{10}$ to 30ths.	17. $\frac{1}{9}, \frac{6}{9}, \frac{1}{12}, \frac{7}{12}$ to 72ds.
11. $\frac{1}{4}, \frac{2}{9}, \frac{1}{12}, \frac{7}{12}$ to 36ths.	18. $\frac{1}{10}, \frac{3}{20}, \frac{1}{50}, \frac{3}{4}$ to 100ths.
12. $\frac{1}{6}, \frac{3}{8}, \frac{7}{12}, \frac{5}{16}$ to 48ths.	19. $\frac{1}{10}, \frac{1}{12}, \frac{1}{15}, \frac{1}{20}$ to 120ths.

123. To change a fraction to smaller terms.

By what number must both terms of the fraction be divided to change $\frac{6}{15}$ to $\frac{2}{5}$? To change $\frac{3}{8}$ to $\frac{1}{4}$? When the fraction $\frac{3}{8}$ is changed to $\frac{1}{4}$, what change is made in the size of the parts? In the *number* of the parts taken?

A fraction can be changed to smaller terms by dividing both terms by the same number.

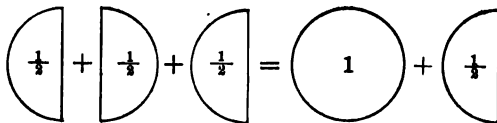
To change a fraction to its smallest terms: *Strike out all the factors common to both terms.*

124. Oral and Sight Exercises.

Change to their smallest terms:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>
20.	$\frac{2}{10}$	$\frac{4}{16}$	$\frac{6}{18}$	$\frac{16}{18}$	$\frac{12}{15}$	$\frac{16}{20}$	$\frac{8}{12}$	$\frac{12}{18}$	$\frac{6}{16}$
21.	$\frac{2}{14}$	$\frac{6}{10}$	$\frac{2}{3}$	$\frac{9}{15}$	$\frac{12}{20}$	$\frac{18}{21}$	$\frac{10}{15}$	$\frac{10}{14}$	$\frac{8}{20}$
22.	$\frac{10}{16}$	$\frac{2}{22}$	$\frac{15}{20}$	$\frac{9}{18}$	$\frac{8}{20}$	$\frac{14}{21}$	$\frac{12}{16}$	$\frac{6}{24}$	$\frac{18}{24}$
23.	$\frac{9}{21}$	$\frac{18}{80}$	$\frac{14}{18}$	$\frac{24}{28}$	$\frac{42}{60}$	$\frac{24}{80}$	$\frac{24}{72}$	$\frac{3}{75}$	$\frac{30}{100}$
24.	$\frac{15}{24}$	$\frac{18}{88}$	$\frac{30}{40}$	$\frac{20}{45}$	$\frac{32}{56}$	$\frac{18}{45}$	$\frac{24}{56}$	$\frac{25}{75}$	$\frac{40}{80}$
25.	$\frac{6}{30}$	$\frac{8}{40}$	$\frac{6}{54}$	$\frac{24}{60}$	$\frac{16}{48}$	$\frac{12}{60}$	$\frac{18}{60}$	$\frac{20}{100}$	$\frac{360}{720}$

125. To change improper fractions to integers or to mixed numbers.



Add $\frac{1}{2}$ circle, $\frac{1}{2}$ circle, and $\frac{1}{2}$ circle. *Ans.* $\frac{3}{2}$ circles = $1\frac{1}{2}$ circles. Add $\frac{3}{4}$ of an inch, $\frac{1}{4}$ of an inch, and $\frac{3}{4}$ of an inch. *Ans.* $\frac{7}{4}$ inch = $1\frac{3}{4}$ inch.

A fraction that is less than an integral unit, as $\frac{1}{4}$ inch, is a **proper fraction**. A fraction that equals or exceeds an integral unit, as $\frac{4}{4}$ or $\frac{7}{4}$, is an **improper fraction**. A number consisting of an integer and a fraction, as $1\frac{3}{4}$, is a **mixed number**.

Change $\frac{8}{2}$ and $\frac{3}{2}$ to integers or to mixed numbers.

Since 2 halves equal a unit, in $\frac{8}{2}$ there are as many units as there are 2's in 8, or 4. *Ans.* $\frac{8}{2}=4$; $\frac{3}{2}=1\frac{1}{2}$.

126. Illustrative Example. — Change $\frac{200}{12}$ to an integer or a mixed number.

WRITTEN WORK.

$$\begin{array}{r} 12 \overline{)200} \\ \underline{168} \\ 32 \end{array}$$

To change an improper fraction to an integer or a mixed number: *Divide the numerator by the denominator.*

127. Oral Exercises.

Change to integers or to mixed numbers :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>
26.	$\frac{18}{4}$	$\frac{57}{7}$	$\frac{48}{5}$	$\frac{61}{2}$	$\frac{37}{3}$	$\frac{63}{10}$	$\frac{27}{12}$	$\frac{62}{5}$	$\frac{108}{12}$
27.	$\frac{54}{9}$	$\frac{45}{6}$	$\frac{70}{11}$	$\frac{63}{8}$	$\frac{62}{7}$	$\frac{55}{4}$	$\frac{75}{8}$	$\frac{174}{10}$	$\frac{100}{9}$
28.	$\frac{59}{11}$	$\frac{77}{9}$	$\frac{67}{5}$	$\frac{56}{8}$	$\frac{59}{11}$	$\frac{48}{7}$	$\frac{82}{9}$	$\frac{74}{8}$	$\frac{101}{12}$

128. Examples for Written Work.

Change to integers or mixed numbers and express the results in their smallest terms :

29. $\frac{183}{16}$. 32. $\frac{457}{21}$. 35. $\frac{559}{24}$. 38. $\frac{673}{32}$. 41. $\frac{833}{66}$.
 30. $\frac{120}{17}$. 33. $\frac{500}{22}$. 36. $\frac{625}{25}$. 39. $\frac{784}{43}$. 42. $\frac{875}{74}$.
 31. $\frac{382}{19}$. 34. $\frac{483}{28}$. 37. $\frac{589}{51}$. 40. $\frac{891}{38}$. 43. $\frac{792}{66}$.

129. To change integers or mixed numbers to improper fractions.

Illustrative Example. — Change $26\frac{3}{4}$ to an improper fraction.

WRITTEN WORK.

$$26\frac{3}{4} = \frac{107}{4}$$

To change an integer or a mixed number to an improper fraction: *Multiply the integer by the denominator of the fraction, and to the product add the numerator. The result will be the numerator of the required fraction.*

130. Examples for Oral or Written Work.

Change to improper fractions :

44. $2\frac{3}{4}$; $5\frac{2}{3}$; $7\frac{3}{4}$; $10\frac{3}{5}$; $5\frac{5}{9}$; $5\frac{5}{7}$; $10\frac{8}{11}$; $11\frac{1}{3}$.
 45. $8\frac{1}{3}$; $7\frac{3}{5}$; $6\frac{7}{8}$; $9\frac{4}{6}$; * $7\frac{7}{8}$; $6\frac{7}{10}$; $10\frac{5}{12}$; $10\frac{9}{7}$.
 46. $9\frac{4}{5}$; $6\frac{5}{6}$; $4\frac{5}{9}$; $9\frac{5}{8}$; $6\frac{6}{9}$; $11\frac{8}{12}$; $12\frac{9}{10}$; $9\frac{2}{11}$.

131. Examples for Written Work.

Change to improper fractions :

47. $84\frac{1}{2}$. 51. $70\frac{8}{7}$. 55. $100\frac{7}{8}$. 59. $125\frac{5}{12}$. 63. $180\frac{3}{15}$.
 48. $53\frac{3}{4}$. 52. $86\frac{3}{5}$. 56. $106\frac{5}{7}$. 60. $272\frac{1}{4}$. 64. $207\frac{7}{10}$.
 49. $30\frac{1}{4}$. 53. $77\frac{6}{8}$. 57. $125\frac{5}{10}$. 61. $369\frac{8}{9}$. 65. $614\frac{1}{2}$.
 50. $69\frac{4}{5}$. 54. $89\frac{4}{9}$. 58. $341\frac{8}{9}$. 62. $704\frac{1}{12}$. 66. $983\frac{19}{100}$.

* First change the fraction to its smallest terms.

ADDITION AND SUBTRACTION OF FRACTIONS.

132. Examples for Oral or Written Work.

Add, and change the result to integers or mixed numbers :

67. $\frac{1}{3} + \frac{2}{3} + \frac{1}{3}$.

69. $\frac{2}{5} + \frac{1}{5} + \frac{3}{5}$.

71. $\frac{7}{8} + \frac{5}{8} + \frac{3}{8}$.

68. $\frac{3}{4} + \frac{2}{4} + \frac{1}{4}$.

70. $\frac{3}{6} + \frac{5}{6} + \frac{4}{6}$.

72. $\frac{2}{9} + \frac{4}{9} + \frac{5}{9}$.

Add or subtract as indicated by the signs :

73. $\frac{4}{12} + \frac{7}{12} - \frac{1}{12}$.

74. $\frac{2}{15} + \frac{7}{15} - \frac{4}{15}$.

75. $\frac{4}{11} - \frac{2}{11} + \frac{7}{11}$.

NOTE.—In adding mixed numbers, first add the fractions and carry to the integers.

	Feet			Dimes		Months		Yards	
76.	$6\frac{5}{8}$	77.	$6\frac{5}{8}$	78.	$5\frac{3}{10}$	79.	$3\frac{4}{5}$	80.	$4\frac{2}{3}$
	$4\frac{1}{6}$		$2\frac{3}{8}$		$7\frac{1}{10}$		$7\frac{2}{5}$		$7\frac{1}{3}$
	$3\frac{5}{8}$		$8\frac{3}{8}$		$16\frac{7}{10}$		$4\frac{1}{5}$		$8\frac{2}{3}$
81.	$7\frac{4}{5}$	82.	$9\frac{11}{12}$	83.	$13\frac{13}{80}$	84.	$16\frac{16}{88}$	85.	$14\frac{1}{4}$
	$-4\frac{2}{5}$		$-3\frac{7}{12}$		$-7\frac{7}{80}$		$-9\frac{9}{88}$		$-2\frac{3}{4}$

NOTE.—In example 85, as $\frac{3}{4}$ is more than $\frac{1}{4}$, first change one of the 14 to fourths.

86.	$13\frac{4}{9}$	87.	$15\frac{8}{10}$	88.	$16\frac{5}{11}$	89.	$17\frac{1}{12}$	90.	$31\frac{7}{15}$
	$-7\frac{8}{9}$		$-7\frac{7}{10}$		$-9\frac{9}{11}$		$-7\frac{5}{12}$		$-19\frac{8}{15}$

133. Fractions which are like parts of the same or similar units are **like fractions**.

Thus $\frac{3}{4}$ bushel and $\frac{1}{4}$ bushel are like parts (fourths) of like units (bushels), and are therefore like fractions. Are $\frac{1}{2}$ of a bushel and $\frac{1}{4}$ of a bushel like fractions? Are $\frac{1}{4}$ of a bushel and $\frac{1}{4}$ of a yard like fractions?

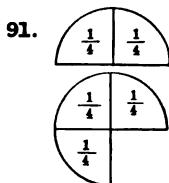
Only like fractions can be added or subtracted.

How do you add like fractions? How do you subtract like fractions?

134. Like fractions have the same denominator and so are said to have a **common denominator**.

135. To add and subtract fractions not having a common denominator.

Change to a common denominator and add:



a
Circle
 $\frac{1}{2}$
 $\frac{3}{4}$
 $\frac{1}{4}$
 $1\frac{1}{4}$

b
Oblong
 $\frac{1}{2}$
 $\frac{3}{8}$
 $\frac{1}{8}$

c
Square
 $\frac{7}{8}$
 $\frac{1}{2}$

Dime
92. $\frac{4}{5} + \frac{1}{10} = ?$

Dime
93. $\frac{9}{10} + \frac{2}{5} = ?$

Pentagon
94. $\frac{4}{5} - \frac{3}{10} = ?$

Hexagon
95. $\frac{5}{6} - \frac{2}{3} = ?$

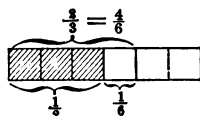
136. Illustrative Example. — If from a board $\frac{2}{3}$ of a foot in length $\frac{1}{2}$ of a foot was taken, what part of a foot remained?

$$\frac{2}{3} = \frac{4}{6}; \frac{1}{2} = \frac{3}{6}; \frac{4}{6} - \frac{3}{6} = \frac{1}{6}.$$

Ans. $\frac{1}{6}$ of a foot.

Before taking $\frac{1}{2}$ from $\frac{2}{3}$, what change was made in these fractions?

ILLUSTRATION.



137. Illustrative Example. — Add together $\frac{2}{3}$ ft., $\frac{1}{4}$ ft., and $\frac{1}{6}$ ft.

WRITTEN WORK.

l. c. m. $= 6 \times 2 = 12$.

$$\frac{2}{3} + \frac{1}{4} + \frac{1}{6} = \frac{8+3+2}{12} = \frac{13}{12} = 1\frac{1}{12}.$$

First find the least common multiple of the denominators of the fractions, which is 12.

Multiplying both terms of $\frac{2}{3}$ by 4, both terms of $\frac{1}{4}$ by 3, and both terms of $\frac{1}{6}$ by 2, the resulting fractions are $\frac{8}{12}$, $\frac{3}{12}$, and $\frac{2}{12}$, which, added, equal $\frac{13}{12}$, or $1\frac{1}{12}$. Ans. $1\frac{1}{12}$ feet.

138. Examples for Oral or Written Work.

96. $\frac{3}{4} + \frac{1}{3} = ?$ 100. $\frac{4}{5} - \frac{7}{10} = ?$ 104. $5\frac{1}{2} + 2\frac{1}{4} = ?$
 97. $\frac{7}{10} - \frac{2}{3} = ?$ 101. $\frac{5}{8} - \frac{7}{12} = ?$ 105. $8\frac{3}{8} + 9\frac{5}{8} = ?$
 98. $\frac{3}{8} - \frac{4}{9} = ?$ 102. $\frac{5}{8} + \frac{7}{9} = ?$ 106. $8\frac{3}{8} - 6\frac{8}{9} = ?$
 99. $\frac{3}{4} + \frac{3}{10} = ?$ 103. $\frac{7}{8} - \frac{5}{12} = ?$ 107. $13\frac{3}{8} - 5\frac{7}{10} = ?$

Examples for Written Work.

139. 108. $7\frac{3}{8} + 9\frac{3}{8} + 10\frac{1}{8}$. 112. $5\frac{2}{5} + 15\frac{1}{5} + 17\frac{3}{5}$.
 109. $12\frac{3}{4} + 9\frac{1}{12} + 5\frac{1}{6}$. 113. $16\frac{3}{8} + 20\frac{3}{10} + 14\frac{4}{5}$.
 110. $9\frac{5}{8} + 5\frac{3}{8} + 12\frac{7}{12}$. 114. $8\frac{7}{10} + 15\frac{5}{12} + 10\frac{1}{6}$.
 111. $33\frac{3}{4} + 26\frac{5}{8} + 4\frac{8}{9}$. 115. $17\frac{5}{8} + 5\frac{4}{9} + 4\frac{1}{12}$.

Subtract in lines and in columns:

- | | | | | | |
|-----------------------------------------|------------------------------------------|-----------------------------------------|------|------|------|
| 118. | 119. | 122. | 123. | 126. | 127. |
| 116. $14\frac{5}{8} - 9\frac{7}{8}$ | 120. $44\frac{1}{10} - 19\frac{3}{8}$ | 124. $80\frac{7}{10} - 80\frac{1}{8}$ | | | |
| 117. $11\frac{3}{8} - 9\frac{3}{8}$ | 121. $29\frac{4}{9} - 15\frac{5}{9}$ | 125. $35\frac{11}{12} - 26\frac{9}{14}$ | | | |
| 130. | 131. | 134. | 135. | 138. | 139. |
| 128. $72\frac{5}{12} - 45\frac{11}{18}$ | 132. $100\frac{4}{15} - 70\frac{13}{30}$ | 136. $17\frac{3}{8} - 14\frac{4}{7}$ | | | |
| 129. $47\frac{7}{15} - 29\frac{5}{9}$ | 133. $68\frac{3}{8} - 9\frac{2}{20}$ | 137. $12\frac{2}{5} - 8\frac{5}{12}$ | | | |

140. To make some boxes $2\frac{5}{8}$ pounds of finishing nails were used, $1\frac{3}{4}$ pounds of brads, and $\frac{5}{8}$ of a pound of gimp tacks. What weight in all was used?

141. A peddler spent in one day $\$2\frac{3}{10}$ for the use of a team, $\$ \frac{3}{4}$ for keeping it, and $\$1\frac{1}{5}$ for other expenses. How much did he spend in all?

142. After $\frac{1}{3}$ of a class have left and $\frac{2}{7}$ have been promoted, what part of the class remains?

143. A whip handle is $\frac{3}{4}$ of a yard long, and the lash is $2\frac{1}{8}$ yards long. How long are both together? How much longer is the lash than the handle?

144. A quart, dry measure, contains $67\frac{1}{2}$ cubic inches; a quart, liquid measure, contains $57\frac{1}{4}$ cubic inches. How much larger is the dry quart than the liquid quart?

145. To plough a field took $8\frac{5}{8}$ hours; to plant it took $15\frac{1}{2}$ hours. How much longer did it take to plant the field than to plough it?

146. A can do a piece of work in 5 days, B can do it in 7 days. What part of the work can each do in a day? What part can both together do in a day?

147. James is $5\frac{3}{4}$ feet in height, and John is $3\frac{3}{4}$ feet. How much taller is James than John?

148. From $18\frac{3}{8}$ yards of cloth were cut $7\frac{1}{2}$ yards and $3\frac{3}{4}$ yards. How much was left?

149. From a basket containing $19\frac{3}{4}$ quarts, $5\frac{4}{5}$ quarts were taken. How many quarts were left?

150. A man had $5\frac{5}{11}$ acres of land and sold $1\frac{1}{4}$ acres for a house lot. How much did he keep?

151. In a gale the top of a tree measuring $25\frac{5}{12}$ feet was broken off $17\frac{1}{4}$ feet from the ground. What was the height of the tree before the gale?

152. Upon a street a walk was laid $23\frac{1}{2}$ rods in one direction and $19\frac{7}{11}$ rods in the opposite direction. What length of walk was laid?

153. How many pounds are there in 4 cheeses, weighing respectively $26\frac{1}{8}$, $29\frac{3}{16}$, $31\frac{3}{4}$, and $31\frac{1}{2}$ pounds?

154. Of his property of \$25,000, a man left by will $\frac{1}{2}$ to a town library, $\frac{1}{8}$ to a hospital, and the rest to his cousin. How many dollars did he leave to his cousin?

155. Two engines start from the same point and go in opposite directions, one at the rate of $16\frac{1}{5}$ miles an hour, and the other at the rate of $19\frac{7}{12}$ miles an hour. How far apart will they be at the end of an hour?

MULTIPLICATION OF FRACTIONS.

140. To multiply a fraction by an integer.

Illustrative Examples.—Find the cost of 5 chairs

- (1) at \$ $\frac{3}{4}$ a piece; (2) at \$ $\frac{3}{10}$ a piece.

WRITTEN WORK.

$$(1) \quad \frac{3}{4} \times 5 = \frac{15}{4} = 3\frac{3}{4}.$$

$$(2) \quad \frac{3}{10} \times 5 = \frac{3}{2} = 1\frac{1}{2}.$$

(1) Since 1 chair costs \$ $\frac{3}{4}$, 5 chairs will cost 5 times \$ $\frac{3}{4}$, which is \$ $3\frac{3}{4}$. *Ans.* \$ $3\frac{3}{4}$. Here the numerator 3 is multiplied by 5.

(2) In multiplying \$ $\frac{3}{10}$ by 5, after expressing the multiplication as in the first case, the 5 is canceled, which has the effect of dividing the denominator by 5. *Ans.* \$ $1\frac{1}{2}$.

In the first case above, what change was made in the *number* of parts? In the second case, what change was made in the *size* of the parts?

From this it will be seen that a *fraction is multiplied by multiplying its numerator or by dividing its denominator.*

141. Examples for Oral or Written Work.

Multiply:

- | | | | |
|------------------------|-------------------------|---------------------------|---------------------------|
| 1. $\frac{2}{3}$ by 5. | 5. $\frac{5}{8}$ by 4. | 9. $\frac{7}{12}$ by 4. | 13. $\frac{5}{14}$ by 7. |
| 2. $\frac{3}{4}$ by 5. | 6. $\frac{7}{10}$ by 7. | 10. $\frac{8}{9}$ by 6. | 14. $\frac{4}{15}$ by 6. |
| 3. $\frac{4}{5}$ by 5. | 7. $\frac{9}{10}$ by 5. | 11. $\frac{8}{15}$ by 10. | 15. $\frac{9}{20}$ by 8. |
| 4. $\frac{5}{6}$ by 3. | 8. $\frac{6}{7}$ by 6. | 12. $\frac{7}{8}$ by 7. | 16. $\frac{11}{12}$ by 9. |

17. What must be paid for 3 yards of silk at \$ $\frac{3}{8}$ a yard?

18. At \$ $\frac{5}{8}$ each, what is the cost of the cane-seating of half a dozen chairs?

19. If it takes $\frac{5}{12}$ of a year for a sum of money to earn \$1, how long will it take for it to earn \$2? \$6? \$9?

20. At \$ $\frac{3}{10}$ an hour, how many dollars will it take to pay for 7 hours' work? for 9 hours' work?

142. Illustrative Example.—Multiply $5\frac{1}{2}$ yards by 9.

WRITTEN WORK.

$$5 \times 9 = 45$$

$$\frac{1}{2} \times 9 = 4\frac{1}{2}$$

$$49\frac{1}{2}$$

Multiplying the fraction and the integer separately and adding the results, their sum is $49\frac{1}{2}$. *Ans.* $49\frac{1}{2}$ yards.

21. A marble slab is 3 feet long and $2\frac{1}{4}$ feet wide. How many square feet are there in its upper surface?

Find the cost of misses' shoes as follows :

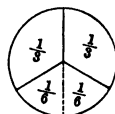
22. Of 4 dozen pairs at $\$8\frac{1}{3}$ per dozen.

23. Of 6 dozen pairs at $\$7\frac{1}{2}$ per dozen.

24. Of 10 dozen pairs at $\$6\frac{3}{4}$ per dozen.

143. To multiply an integer or a fraction by a fraction.

What is $\frac{1}{2}$ of $\frac{1}{3}$? Draw diagrams to show $\frac{1}{3}$ of $\frac{1}{2}$; $\frac{1}{2}$ of $\frac{1}{6}$; $\frac{1}{3}$ of $\frac{1}{3}$.



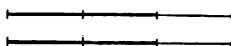
Illustrative Examples.—Find (1) $\frac{2}{3}$ of 2; (2) $\frac{2}{3}$ of $\frac{2}{5}$.

WRITTEN WORK.

(1)

$$\frac{2}{3} \text{ of } 2 = \frac{2 \times 2}{3} = \frac{4}{3} = 1\frac{1}{3}.$$

ILLUSTRATION.

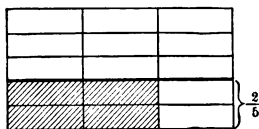


$$\frac{2}{3} \text{ of } 2 = \frac{4}{3} = 1\frac{1}{3}.$$

(2)

$$\frac{2}{3} \text{ of } \frac{2}{5} = \frac{2 \times 2}{3 \times 5} = \frac{4}{15}.$$

ILLUSTRATION.



$$\frac{2}{3} \text{ of } \frac{2}{5} = \frac{4}{15}.$$

(1) $\frac{1}{3}$ of 2 = $\frac{2}{3}$; and $\frac{2}{3}$ of 2 = 2 times $\frac{2}{3}$ or $\frac{4}{3} = 1\frac{1}{3}$. *Ans.* $1\frac{1}{3}$.

(2) $\frac{1}{3}$ of $\frac{1}{5}$ is one of the three equal parts into which $\frac{1}{5}$ is divided. Since the entire unit $\frac{1}{5}$ will contain 5 times 3 or 15 such parts, one of the parts will be $\frac{1}{15}$ of the unit. Hence $\frac{1}{3}$ of $\frac{1}{5} = \frac{1}{15}$; $\frac{2}{3}$ of $\frac{1}{5} = \frac{2}{15}$, and $\frac{2}{3}$ of $\frac{2}{5} = \frac{4}{15}$. *Ans.* $\frac{4}{15}$.

Finding the fractional part of a number is called **multiplying by a fraction**.

In finding $\frac{3}{4}$ of 2, what numbers were multiplied together?

By what was the result divided?

In finding $\frac{3}{4}$ of $\frac{2}{3}$, how was the new denominator obtained?

How was the new numerator obtained?

144. Oral Exercises.

25. What is $\frac{2}{3}$ of 10? $\frac{3}{4}$ of 20? $\frac{5}{8}$ of 24? $\frac{7}{8}$ of 32?

26. What is $\frac{5}{7}$ of $\frac{2}{3}$? $\frac{4}{9}$ of $\frac{2}{5}$? $\frac{2}{3}$ of $\frac{4}{5}$? $\frac{7}{12}$ of $\frac{3}{4}$?

27. Multiply 4 inches by $\frac{3}{4}$.

Solution.—To multiply 4 inches by $\frac{3}{4}$ is to take $\frac{3}{4}$ of 4 inches, etc.

28. Multiply 2 feet by $\frac{3}{4}$; 50 cents by $\frac{3}{5}$; $\frac{1}{2}$ dollar by $\frac{3}{5}$.

29. Multiply 3 pounds by $\frac{3}{8}$; 40¢ by $\frac{7}{10}$; $\$ \frac{2}{5}$ by $\frac{7}{10}$.

30. Multiply 2 years by $\frac{2}{3}$; 24 months by $\frac{2}{3}$; 32 ounces by $\frac{3}{4}$.

Name at sight the products of the following:

31.	32.	33.	34.
a. $\frac{2}{3}$ of 4;	$\frac{2}{3}$ of 3;	$\frac{3}{4} \times \frac{2}{5}$;	$\frac{5}{8} \times \frac{1}{9}$.
b. $\frac{2}{3}$ of $\frac{4}{5}$;	$\frac{2}{3}$ of $\frac{3}{4}$;	$\frac{2}{5} \times \frac{3}{6}$;	$\frac{3}{5} \times \frac{2}{3}$.
c. $\frac{3}{5}$ of 3;	$\frac{3}{4}$ of 5;	$\frac{7}{12} \times \frac{2}{3}$;	$\frac{6}{7} \times \frac{3}{8}$.
d. $\frac{3}{5}$ of $\frac{4}{8}$;	$\frac{3}{4}$ of $\frac{5}{6}$;	$\frac{5}{8} \times \frac{4}{9}$;	$\frac{7}{10} \times \frac{2}{3}$.
e. $\frac{2}{7}$ of $\frac{12}{15}$;	$\frac{1}{9}$ of $\frac{5}{6}$;	$7 \times \frac{6}{7}$;	$\frac{4}{11} \times \frac{6}{7}$.

145. 1. To multiply an integer by a fraction, or a fraction by an integer: *Multiply together the integer and the numerator of the fraction for the numerator of the product, and take the denominator of the fraction for the denominator of the product.*

2. To multiply a fraction by a fraction: *Multiply together the numerators of the fractions for the numerator of the product, and the denominators of the fractions for the denominator of the product.*

146. Examples for Written Work.

Find the products of the following :

35. $\frac{2}{3}$ of $\frac{3}{11}$. 38. $\frac{2}{3}$ of $\frac{5}{12}$. 41. $\frac{7}{12} \times \frac{3}{8}$. 44. $\frac{5}{17} \times \frac{3}{20}$.
 36. $\frac{2}{15}$ of $\frac{3}{8}$. 39. $\frac{5}{9}$ of $\frac{7}{16}$. 42. $\frac{5}{18} \times \frac{4}{9}$. 45. $\frac{7}{10} \times \frac{2}{9}$.
 37. $\frac{2}{7}$ of $\frac{12}{15}$. 40. $\frac{4}{9}$ of $\frac{12}{18}$. 43. $7 \times \frac{7}{24}$. 46. $\frac{4}{21} \times \frac{7}{16}$.

147. Illustrative Example.—There are 320 rods in 1 mile. How many rods are there in $5\frac{2}{3}$ miles?

WRITTEN WORK.

320 Multiplying by the fraction and the integer
 $5\frac{2}{3}$ separately and adding the products, as in the
 $3 \overline{)640}$ margin, the result is $1813\frac{1}{3}$.
 213 $\frac{1}{3}$ *Ans.* $1813\frac{1}{3}$ rods.
 1600 47. How many quarts are there in 1
 1813 $\frac{1}{3}$ bushel? in $6\frac{2}{3}$ bushels?

48. How many inches are there in 1 yard? in $7\frac{1}{2}$ yards?

49. How many days are there in $9\frac{2}{3}$ weeks?

50. At \$8 a week for board, how much must be paid for $4\frac{1}{2}$ weeks' board? for $8\frac{2}{3}$ weeks' board?

148. Illustrative Example.—Multiply $3\frac{7}{8}$ by $2\frac{1}{5}$.

WRITTEN WORK.

7 In multiplying together mixed num-
 $\frac{31 \times 14}{8 \times 5} = \frac{217}{20} = 10\frac{17}{20}$. bers, or fractions and mixed numbers,
 4 *first change the mixed numbers to improper*
 fractions.
 Ans. $10\frac{17}{20}$.

Multiply the following in lines and in columns:

- | | | | | | |
|---------------------------------------|------------------------------------------|--------------------------------------------|-----|-----|-----|
| 53. | 54. | 57. | 58. | 61. | 62. |
| 51. $\frac{2}{5}$ of $7\frac{1}{2}$. | 55. $8\frac{3}{4} \times 5\frac{2}{5}$. | 59. $4\frac{7}{11} \times 14\frac{2}{3}$. | | | |
| 52. $\frac{5}{9}$ of $5\frac{1}{2}$. | 56. $7\frac{5}{7} \times 8\frac{1}{8}$. | 60. $7\frac{7}{8} \times 6\frac{2}{3}$. | | | |

149. Illustrative Example.—What part of a yard is $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of a yard?

WRITTEN WORK.

$$\frac{4 \times 3 \times 1}{5 \times 4 \times 2} = \frac{3}{10}.$$

Ans. $\frac{3}{10}$ yard.

63. $\frac{1}{8}$ of $\frac{5}{8}$ of $\frac{4}{9} = ?$

64. $\frac{5}{7}$ of $\frac{8}{15}$ of $\frac{3}{11} = ?$

65. $\frac{9}{13}$ of $\frac{4}{15}$ of $\frac{2}{3} = ?$

66. When one side of a square field is $13\frac{3}{11}$ rods in length, how many rods of fencing will be required to inclose the field?

67. If 5 men can do a piece of work in $3\frac{5}{8}$ days, how long will it take 1 man to do it?

68. How many inches are there in a rod, or $16\frac{1}{2}$ feet?

69. If the average weight of a dozen eggs is $1\frac{7}{8}$ pounds, how much will $12\frac{1}{2}$ dozen weigh?

70. What will be the cost of $\frac{3}{4}$ of an acre of land at \$45 $\frac{1}{2}$ an acre?

71. Dana can walk a mile in $18\frac{1}{2}$ minutes. How long will it take him to walk $4\frac{1}{3}$ miles?

72. A cubic foot of water weighs $62\frac{1}{2}$ pounds. How many ounces does it weigh?

73. How many pounds of pressure are there on the bottom of a tank that contains $67\frac{3}{8}$ cubic feet of water?

74. Find the number of square feet in a mat $14\frac{1}{3}$ feet long and $12\frac{1}{2}$ feet wide.

75. Find the number of square feet in a floor $18\frac{2}{3}$ feet long and $15\frac{1}{4}$ feet wide.

76. When a furnace consumes coal at the rate of $\frac{4}{5}$ of a ton per day, how much will it consume in $4\frac{2}{7}$ weeks?

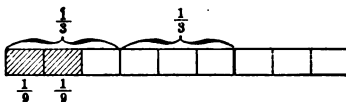
77. At the rate of a mile in $\frac{3}{10}$ of an hour, in how many hours could a person walk around an oblong park that is $3\frac{1}{2}$ miles long and $2\frac{1}{3}$ miles wide?

DIVISION.

150. To divide a fraction by an integer.

Illustrative Examples. — (1) Divide $\frac{2}{3}$ of a yard of ribbon between 2 girls; (2) among 3 girls.

ILLUSTRATION. — (1) Each of 2 girls will have 1 half of $\frac{2}{3}$, or $\frac{1}{3}$ of a yard. *Ans.* $\frac{1}{3}$ yard.



Here the numerator of $\frac{2}{3}$ is divided by 2.

(2) Each of 3 girls will have 1 third of $\frac{2}{3}$ of a yard; $\frac{1}{3}$ of $\frac{1}{3}$ is $\frac{1}{9}$, and $\frac{2}{3}$ of $\frac{1}{3}$ is $\frac{2}{9}$. *Ans.* $\frac{2}{9}$ yard.

Here the denominator of $\frac{2}{3}$ is multiplied by 3.

In dividing $\frac{2}{3}$ by 2 what change was made in the *number* of parts? In dividing $\frac{2}{3}$ by 3 what change was made in the *size* of the parts?

From this it will be seen that a *fraction is divided by dividing its numerator or by multiplying its denominator.*

151. Examples for Oral or Written Work.

1. Divide $\frac{3}{4}$ by 3; $\frac{2}{4}$ by 3; $\frac{6}{7}$ by 2; $\frac{8}{8}$ by 4; $\frac{8}{8}$ by 5.
2. Divide $\frac{3}{4}$ by 2; $\frac{3}{4}$ by 3; $\frac{5}{7}$ by 2; $\frac{8}{8}$ by 3; $\frac{4}{5}$ by 5.
3. Divide $\frac{7}{8}$ by 2; $\frac{6}{8}$ by 3; $\frac{4}{11}$ by 6; $\frac{5}{12}$ by 3; $\frac{2}{10}$ by 3.
4. What is the cost of one rose bush, if 7 cost $\$1\frac{3}{4}$?

NOTE. — First change $1\frac{3}{4}$ to an improper fraction.

5. Four men shared equally in paying for a meal that cost $\$1\frac{3}{8}$. What was the share of each?

6. A boarding house furnished 7 breakfasts for $\$1\frac{1}{2}$, 7 dinners for $\$1\frac{3}{4}$, and seven suppers for $\$1$. What was the cost of 1 breakfast? of 1 dinner? of 1 supper?

152. Illustrative Example. — A family used $7\frac{1}{4}$ bushels of potatoes in 4 months. What was the average number of bushels used per month?

WRITTEN WORK.

$$\begin{array}{r} 4 \overline{) 7\frac{1}{4}} \\ 11\frac{3}{8} \end{array}$$

When the dividend contains an integer greater than the divisor, the integer is divided first, and the remainder only is changed to an improper fraction.

7. How much is 1 fare from Boston to the White Mountains, when 5 fares cost $\$31\frac{1}{4}$?

8. A floor is $10\frac{1}{2}$ yards wide. What must be the width of matting 7 breadths of which laid lengthwise will just cover it?

9. When 10 breadths of wall paper reach $24\frac{1}{8}$ feet, how many feet wide is the paper?

10. Divide $1\frac{2}{3}$ by 6; $2\frac{3}{8}$ by 4; $5\frac{1}{4}$ by 3; $8\frac{3}{4}$ by 5.

11. Divide $14\frac{2}{3}$ by 4; by 5; by 6; by 7; by 8; by 9.

153. Examples for Written Work.

12. Mrs. Hart sold 27 bouquets for $\$10\frac{1}{8}$. How much did she receive apiece for them?

13. If a field can be reaped in $7\frac{2}{3}$ days, in what time could a field 1 tenth as large be reaped?

14. Mr. Clark paid $\$70\frac{1}{2}$ for board for 62 days. What was the price per day?

15. If 1 boy can do a piece of work in $11\frac{5}{8}$ days, in what time can 8 do it? In what time can 10 do it?

16. If $\$119\frac{1}{4}$ will buy 9 dozen books, what is the cost of 1 dozen? of 1 book?

17. In 5 square rods there are $151\frac{1}{4}$ square feet. How many square feet are there in 1 square rod?

18. Divide $\frac{3}{4}$ by 27.

21. $\frac{4}{5} + 110 = ?$

19. Divide $\frac{3}{4}$ by 26.

22. $9\frac{1}{2} + 42 = ?$

20. Divide $1\frac{2}{3}$ by 25.

23. $16\frac{2}{3} + 20 = ?$

Oral Exercises.

154. To divide an integer or a fraction by a fraction.

24. In one there are how many halves? thirds? fourths?

25. In two there are how many fourths? fifths?

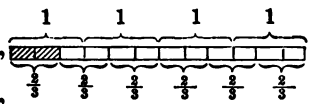
26. In three there are how many times $\frac{1}{2}$? $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{6}$? $\frac{1}{9}$?

To divide by $\frac{1}{2}$ is the same as to multiply by what number?
To divide by $\frac{1}{3}$ is the same as to multiply by what?

155. Illustrative Example.—How many times must a dish that holds $\frac{2}{3}$ of a quart be filled to measure out 4 quarts?

ILLUSTRATION.

WRITTEN WORK.

$$4 \div \frac{2}{3} = 1\frac{2}{3} + \frac{2}{3} = 1\frac{2}{3} = 6, \quad \text{or} \quad \frac{4 \times 3}{2} = 6,$$


The dish must be filled as many times as there are times $\frac{2}{3}$ in 4. In 4 there are $1\frac{2}{3}$. There are as many times $\frac{2}{3}$ in $1\frac{2}{3}$ as there are times 2 in 12, which is 6. *Ans.* 6 times.

In the last form of the written work, above, the dividend 4 is multiplied by $\frac{3}{2}$. But $\frac{3}{2}$ is the expression of the divisor, $\frac{2}{3}$, inverted.

156. Examples for Oral or Written Work.

27. How many towels can Mrs. Fisk make from 8 yards of crash, putting $\frac{4}{5}$ of a yard into each?

28. How many canes at $\$ \frac{5}{8}$ each can be bought for \$10?

29. Divide 5 by $\frac{3}{4}$; by $\frac{4}{5}$; by $\frac{5}{6}$; by $\frac{6}{7}$; by $\frac{7}{8}$; by $\frac{7}{10}$.

30. Divide 8 by $\frac{1}{3}$; by $\frac{2}{5}$; by $\frac{3}{8}$; by $1\frac{1}{4}$ or $\frac{5}{4}$.

To divide an integer by a fraction, how must the integer be changed? What change must be made in a mixed number used as a divisor?

31. Divide $\frac{4}{5}$ by $\frac{2}{5}$; $\frac{8}{9}$ by $\frac{2}{9}$; $\frac{8}{9}$ by $\frac{5}{9}$; $3\frac{1}{8}$ or $\frac{10}{8}$ by $\frac{2}{8}$.

32. Divide $2\frac{2}{3}$ by $\frac{2}{3}$; $4\frac{2}{5}$ by $\frac{2}{5}$; $3\frac{3}{4}$ by $1\frac{1}{4}$; $5\frac{1}{5}$ by $2\frac{2}{5}$.

In performing the examples above, what change was made in the mixed numbers used as dividends? How is one fraction divided by another when both fractions have a common denominator?

157. Illustrative Example. — How many yards of cloth can be made from $2\frac{3}{4}$ pounds of cotton, if $\frac{2}{5}$ of a pound is put into each yard?

WRITTEN WORK.

$$(1) \quad \frac{11}{4} \div \frac{2}{5} = \frac{55}{20} \div \frac{2}{20} = \frac{55}{8} = 6\frac{7}{8}, \text{ or}$$

$$(2) \quad \frac{11 \times 5}{20} \div \frac{4 \times 2}{20} = \frac{11 \times 5}{4 \times 2} = 6\frac{7}{8}, \text{ or}$$

$$(3) \text{ simply} \quad \frac{11 \times 5}{4 \times 2} = 6\frac{7}{8}.$$

$2\frac{3}{4}$ and $\frac{2}{5}$ changed to fractions having a common denominator equal $\frac{55}{20}$ and $\frac{4}{20}$.

Dividing the new numerator, 55, of the dividend by 8, the new numerator of the divisor, the result is $6\frac{7}{8}$.

Ans. $6\frac{7}{8}$ yards.

Or using the factors by which the new numerators are obtained (2) and (3), in changing to a common denominator, we have the original dividend, $\frac{11}{4}$, multiplied by $\frac{5}{5}$. But $\frac{5}{5}$ is the expression of the divisor, $\frac{2}{5}$, inverted.

158. These examples illustrate the following rules:

1. To divide a fraction by an integer: *Divide the numerator or multiply the denominator by the integer.*

2. To divide an integer or a fraction by a fraction: *Change the dividend and divisor to fractions having a common denominator, and then divide the numerator of the dividend by the numerator of the divisor, or*

Invert the expression for the divisor and proceed as in multiplication.

159. Examples for Oral or Written Work.

- | | | |
|---------------------------------------------|----------------------------------------|----------------------------------------|
| 33. Divide $\frac{4}{5}$ by $\frac{2}{3}$. | 37. $\frac{2}{3} \div \frac{8}{9} = ?$ | 41. $\frac{2}{3} \div \frac{2}{5} = ?$ |
| 34. Divide $\frac{5}{6}$ by $\frac{3}{4}$. | 38. $\frac{5}{7} \div \frac{1}{2} = ?$ | 42. $\frac{4}{5} \div \frac{2}{3} = ?$ |
| 35. Divide $\frac{7}{8}$ by $\frac{2}{3}$. | 39. $\frac{3}{5} \div \frac{3}{4} = ?$ | 43. $\frac{2}{3} \div \frac{3}{8} = ?$ |
| 36. Divide $\frac{7}{8}$ by $\frac{3}{4}$. | 40. $\frac{3}{5} \div \frac{5}{6} = ?$ | 44. $\frac{5}{6} \div \frac{4}{5} = ?$ |

160. Examples for Written Work.

- | | | |
|----------------------------------------------|------------------------------------------|--------------------------------------------|
| 45. Divide $1\frac{1}{2}$ by $\frac{2}{5}$. | 50. $5\frac{1}{6} \div \frac{3}{4} = ?$ | 55. $16\frac{2}{3} \div \frac{7}{12} = ?$ |
| 46. Divide $6\frac{1}{4}$ by $\frac{1}{8}$. | 51. $3\frac{2}{5} \div 4\frac{1}{2} = ?$ | 56. $16\frac{2}{3} \div 6\frac{1}{4} = ?$ |
| 47. Divide $6\frac{1}{4}$ by $\frac{4}{5}$. | 52. $12\frac{1}{2} \div \frac{3}{8} = ?$ | 57. $33\frac{1}{3} \div 3\frac{1}{6} = ?$ |
| 48. Divide $3\frac{1}{3}$ by $\frac{2}{5}$. | 53. $12\frac{1}{2} \div \frac{2}{3} = ?$ | 58. $100 \div 66\frac{2}{3} = ?$ |
| 49. Divide $2\frac{1}{2}$ by $\frac{3}{4}$. | 54. $8\frac{1}{3} \div \frac{5}{6} = ?$ | 59. $87\frac{1}{2} \div 12\frac{1}{2} = ?$ |

60. A bushel contains $1\frac{1}{4}$ cubic feet. How many bushels are there in a bin which contains 48 cubic feet?

61. How many steps, $2\frac{3}{4}$ feet each, will a person take in going a rod, or $16\frac{1}{2}$ feet?

62. At $\$7\frac{1}{8}$ a bushel, how many bushels of pears will \$10 buy?

63. When $\frac{3}{8}$ of a yard of ribbon is put into a loop, how many loops can be made from $5\frac{1}{4}$ yards?

64. When coal is $\$6\frac{2}{5}$ a ton, how many tons can be bought for \$45?

65. $15\frac{1}{5}$ rods of stone wall are to be laid by a man who can lay $1\frac{7}{12}$ rods in a day. How many days will it take him to lay it?

66. When a dealer receives $\$54\frac{2}{5}$ for garments at $\$3\frac{2}{10}$ each, how many garments does he sell?

67. Reckoning $31\frac{1}{2}$ gallons to a barrel, how many barrels are there in 567 gallons of vinegar?

68. Beech wood well dried weighs $43\frac{1}{8}$ pounds to the cubic foot. How many cubic feet are there in $258\frac{3}{4}$ pounds?

161. Illustrative Examples.—Change $\frac{12\frac{1}{2}}{100}$ and $\frac{37\frac{1}{2}}{100}$ to simple fractions in their smallest terms.

WRITTEN WORK. $\frac{12\frac{1}{2}}{100}$ is equivalent to $12\frac{1}{2}$ divided by 100.
 $\frac{12\frac{1}{2}}{100} = \frac{25}{200} = \frac{1}{8}$. Multiplying both terms of $\frac{12\frac{1}{2}}{100}$ by 2, we have
 $\frac{25}{200} = \frac{1}{8}$.
 $\frac{37\frac{1}{2}}{100} = \frac{75}{200} = \frac{3}{8}$. Multiplying both terms of $\frac{37\frac{1}{2}}{100}$ by 2, we have
 $\frac{75}{200} = \frac{3}{8}$.

Change to simple fractions in their smallest terms:

- | | | | |
|-------------------------------|---------------------------------|---------------------------------|------------------------------------------|
| 69. $\frac{2\frac{1}{2}}{10}$ | 73. $\frac{62\frac{1}{2}}{100}$ | 77. $\frac{16\frac{2}{3}}{100}$ | 81. $\frac{10}{7\frac{1}{2}}$ |
| 70. $\frac{7\frac{1}{2}}{10}$ | 74. $\frac{87\frac{1}{2}}{100}$ | 78. $\frac{8\frac{1}{3}}{100}$ | 82. $\frac{50}{6\frac{1}{4}}$ |
| 71. $\frac{3\frac{1}{3}}{20}$ | 75. $\frac{33\frac{1}{3}}{100}$ | 79. $\frac{83\frac{1}{3}}{100}$ | 83. $\frac{87\frac{1}{2}}{6\frac{1}{4}}$ |
| 72. $\frac{6\frac{2}{3}}{20}$ | 76. $\frac{66\frac{2}{3}}{100}$ | 80. $\frac{6\frac{1}{4}}{100}$ | 84. $\frac{100}{8\frac{1}{8}}$ |

RELATIONS OF NUMBERS.

162. To find what part one number is of another.

One is what part of 3? of 5? of 7? of 8?

In comparing 1 with any number to see what part it is of that number, what is taken as the numerator? as the denominator?

163. Oral Exercises.

- What part of 8 is 1? 2? 4? 6?
- What part of a year is 6 mo.? 3 mo.? 4 mo.?
- What part of a peck is 4 qt.? 2 qt.?
- What part of 1 pound is 8 oz.? 4 oz.? 2 oz.?

5. What part of 1 hr. is 30 min. ? 20 min. ? 15 min. ?
12 min. ? 10 min. ? 5 min. ?

6. What part of \$1 is 50¢ ? 20¢ ? 40¢ ? 60¢ ? 30¢ ?

7. What part of 10¢ is 5¢ ? $2\frac{1}{2}$ ¢ ? $7\frac{1}{2}$ ¢ ?

8. What part of 100 is 50 ? 25 ? $12\frac{1}{2}$? $6\frac{1}{4}$?

9. A man earned \$100 and spent \$20. What part of his money did he spend ? What part did he keep ?

10. A cap which cost \$1.00 was sold for \$1.25. What part of the cost was the gain ?

11. John can do a piece of work in 6 hours, and James can do it in 8 hours. What part of the work can each do in 1 hour ?

To find what part one number is of another: *Make the number compared the numerator of a fraction, and the number with which it is compared the denominator.*

164. Examples for Written Work.

What part of

12. 100 is $33\frac{1}{3}$? 14. 100 is $66\frac{2}{3}$? 16. $83\frac{1}{3}$ is $16\frac{2}{3}$?

13. 100 is $87\frac{1}{2}$? 15. $87\frac{1}{2}$ is $12\frac{1}{2}$? 17. 75 is $6\frac{1}{4}$?

18. On a debt of \$100 a bankrupt paid \$ $37\frac{1}{2}$. What part of the debt did he pay ?

19. On \$100 worth of plate glass the owner paid \$ $16\frac{2}{3}$ for insuring it against loss by breaking. What part of its worth did he pay ?

20. The rent on a building was \$ $12\frac{1}{2}$ on each \$100 of its value. What part of the value was the rent ?

21. Mr. Jones sold a horse for \$150 which had cost him \$200. How much did he lose ? What part of the cost of the horse was his loss ?

22. If he had sold the horse for \$250, what part of the cost would he have gained ?

Aliquot Parts of Numbers.

165. What is one of the four equal parts of 8? of 10?

One of the equal parts of a number is an **aliquot part** of the number. Thus, $2\frac{1}{2}$ is an aliquot part of 10.

166. Supply the numerators to the following parts :

Of 10	Of 100	Of 100	Of 100	Of 100
$5 = \frac{1}{2}$.	$10 = \frac{1}{10}$.	$50 = \frac{1}{2}$.	$4 = \frac{1}{25}$.	$12\frac{1}{2} = \frac{1}{8}$.
$2\frac{1}{2} = \frac{1}{4}$.	$20 = \frac{1}{5}$.	$25 = \frac{1}{4}$.	$2 = \frac{1}{50}$.	$37\frac{1}{2} = \frac{1}{8}$.
$7\frac{1}{2} = \frac{1}{4}$.	$40 = \frac{1}{5}$.	$75 = \frac{1}{4}$.	$16\frac{2}{3} = \frac{1}{6}$.	$62\frac{1}{2} = \frac{1}{8}$.
$3\frac{1}{3} = \frac{1}{3}$.	$60 = \frac{1}{5}$.	$33\frac{1}{3} = \frac{1}{3}$.	$83\frac{1}{3} = \frac{1}{6}$.	$87\frac{1}{2} = \frac{1}{8}$.
$6\frac{2}{3} = \frac{1}{3}$.	$80 = \frac{1}{5}$.	$66\frac{2}{3} = \frac{1}{3}$.	$8\frac{1}{8} = \frac{1}{12}$.	$6\frac{1}{4} = \frac{1}{16}$.

167. Examples for Oral or Written Work.

Perform the following examples by using the given numbers as aliquot parts of 100 :

23. At $37\frac{1}{2}\phi$ a yard for gingham, what must be paid for 12 yards?

SOLUTION. — $37\frac{1}{2}\phi = \$\frac{3}{8}$. 12 yards at $37\frac{1}{2}\phi$ a yard will cost 12 times $37\frac{1}{2}\phi$, or $37\frac{1}{2}\phi \times 12 = \$4\frac{1}{2}$ or $4\frac{1}{2}$. *Ans.* \$4.50.

What must be paid

24. For 1 dozen pairs of gloves at $33\frac{1}{3}\phi$ a pair?

25. For 1 dozen pairs of slippers at $83\frac{1}{3}\phi$ a pair?

26. For 20 gallons of oil at $8\frac{1}{8}\phi$ a gallon? at $12\frac{1}{2}\phi$?

27. At $33\frac{1}{3}\phi$ each, how many melons can be bought for \$3.00?

SOLUTION. — $33\frac{1}{3}\phi = \$\frac{1}{3}$. As many melons can be bought for \$3.00 as there are times $\frac{1}{3}$ in 3, which is 9. *Ans.* 9 melons.

28. At $16\frac{2}{3}\phi$ each, how many handkerchiefs can be bought for \$1? for \$5? for \$8? for 50¢?

29. For \$4, how many ties can be bought if each tie costs 50¢? 25¢? $12\frac{1}{2}\phi$? $6\frac{1}{4}\phi$? $8\frac{1}{8}\phi$?

168. To find the whole when a part is given.

30. A strip of molding $\frac{2}{3}$ of a foot long costs 8 cents. What is the cost of $\frac{1}{3}$ of a foot? of 1 foot?

If $\frac{2}{3}$ of a foot costs 8 cents, $\frac{1}{3}$ of a foot costs $\frac{1}{2}$ of 8 cents, or 4 cents, and $\frac{1}{3}$ of a foot, or 1 foot, costs 3 times 4 cents, or 12 cents.

Ans. 12 cents.

169. Examples for Oral or Written Work.

What is the price per dozen

31. Of bananas, when $\frac{3}{4}$ of a dozen sell for 15¢?

32. Of oranges, when $\frac{5}{6}$ of a dozen sell for 20¢?

33. Of brooms, when $\frac{2}{3}$ of a dozen sell for \$1.60?

34. Of gaiters, when $1\frac{1}{4}$ dozen sell for \$10?

What is the cost of one,

35. If $\frac{3}{5}$ of a ton of coal costs \$6? If $\frac{7}{10}$ of a rod of fence costs \$35?

36. If $\frac{3}{4}$ of a yard of satin costs 80¢?

37. A boy spends 6 hours in school, which is $\frac{3}{8}$ of his waking hours. What are his waking hours?

38. Butter now sells for 35¢ a pound, which is $\frac{5}{8}$ of the price last month. What was the price last month?

39. If $\frac{2}{11}$ of a bushel of turnips weighs 10 pounds, how much will a bushel weigh?

40. If $\frac{3}{4}$ of a ton of coal occupies 24 cubic feet, how many cubic feet will 1 ton occupy?

41. An exploring party lost $\frac{1}{3}$ of their bread, and in consequence limited themselves to 12 oz. a day. What was their allowance at first?

NOTE. — If $\frac{1}{3}$ was lost, 12 oz. must be $\frac{2}{3}$ of the allowance.

42. Kerosene sells for 14¢ a gallon, which is $\frac{1}{6}$ more than the price last year. What was the price then?

NOTE. — 14 cents must be $\frac{7}{6}$ of the price last year.

43. If 55 pounds is $\frac{2}{3}$ more than the weight of dried apples per bushel, what is their weight per bushel?

44. A fruit dealer increased his stock of oranges $\frac{3}{4}$. If the increase is 30 boxes, what number of boxes had he before?

45. A drover sold $\frac{1}{3}$ of his pigs, and then had 18 pigs left. How many had he at first?

46. A bushel of sweet potatoes weighs 55 pounds; this is $\frac{1}{12}$ less than the weight of common potatoes. What is the weight per bushel of common potatoes?

170. Examples for Written Work.

47. The diameter of a circle is about $\frac{7}{22}$ of its circumference. What is the circumference of a wheel whose diameter is 28 inches?

48. What is the weight of a barrel of beef when $\frac{2}{3}$ of a barrel weighs $133\frac{1}{3}$ pounds?

What is the price per pound in New England :

49. Of mutton chops, when $1\frac{1}{2}$ pounds cost $37\frac{1}{2}\text{¢}$?

50. Of veal cutlets, when $\frac{3}{4}$ of a pound costs $22\frac{1}{2}\text{¢}$?

51. Of veal steak, when $3\frac{1}{4}$ pounds cost 65¢ ?

52. Of beef steak, when $3\frac{1}{2}$ pounds cost \$1.05?

53. Of tenderloin, when $1\frac{7}{8}$ pounds cost 60¢ ?

54. After losing $\frac{1}{4}$ of his sheep, a drover had 138 left. How many sheep had he at first?

55. For the use of some money for a year, my father paid \$24. If this was $\frac{8}{100}$ of the money he borrowed, how much money did he borrow?

56. If a farmer sells a mowing machine for \$48 and thereby gains $\frac{1}{5}$ of what it cost him, how much did it cost him?

171. Miscellaneous Examples.

1. Sarah is required to spend $2\frac{1}{2}$ hours a day in her music, but she wastes $\frac{2}{3}$ of the time. How much time does she waste in a week of 6 days?

2. Mrs. Bean found she would inherit $\frac{1}{3}$ of $\frac{2}{5}$ of $\frac{3}{4}$ of an estate. What part of the estate would she inherit?

3. Mr. Rowe's income is \$3500 a year. His household expenses are $\frac{5}{7}$ of his income, and he spends $\frac{2}{5}$ of the remainder for his son's tuition. How much of his yearly income has he left?

4. Mr. Prince owned $\frac{2}{3}$ of a mill and sold $\frac{4}{5}$ of what he owned. What part of the mill did he sell? What part of the mill did he keep?

5. If the mill was valued at \$48,000, what was the value of the part Mr. Prince had left?

6. If I lend \$350, and receive for its use a sum equal to $\frac{5}{100}$ of it, how much money do I receive?

7. Mr. Allen borrowed money of Mrs. Breck and paid her in return \$1050, which was $\frac{5}{100}$ more than he had borrowed. How much money had he borrowed? How much did he pay for its use?

8. Charles and Thomas are to share \$3540 left them by their uncle. Charles is to have $\frac{1}{2}$ as much as Thomas. How much should each receive?

9. Gunpowder weighs $56\frac{1}{4}$ pounds to the cubic foot. How many cubic feet are there in a keg of powder which weighs 100 pounds?

10. If you and I start at the same place, and I travel east $25\frac{2}{3}$ rods and you travel west $13\frac{7}{11}$ rods, how far apart shall we be?

11. How far apart shall we be if we travel these distances in the same direction?

12. A can shingle a roof in 5 days, B can shingle it in 6 days, and C in 10 days. What part of the roof can each shingle in one day? What part can all together shingle in one day? In how many days can all three working together shingle it?

13. What part of the roof can A and B together shingle in 1 day? In how many days can they shingle it?

14. In what time can B and C together shingle it?

15. In what time can A and C together shingle it?

172. DRILL TABLE. (See Teachers' Key.)

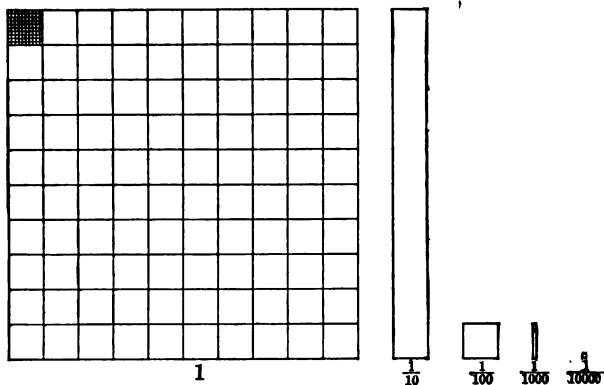
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
A	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{9}$	$\frac{10}{21}$	$\frac{3}{5}$	$\frac{7}{12}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{1}{9}$	$\frac{4}{7}$	$\frac{2}{3}$	$\frac{1}{15}$	$\frac{1}{2}$	$\frac{5}{7}$	$\frac{2}{3}$	A
B	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{5}{8}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{7}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{1}{9}$	$\frac{2}{5}$	$\frac{3}{7}$	$\frac{8}{9}$	$\frac{5}{8}$	B
C	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{3}{8}$	$\frac{13}{21}$	$\frac{15}{20}$	$\frac{2}{3}$	$\frac{2}{4}$	$\frac{3}{8}$	$\frac{10}{21}$	$\frac{3}{5}$	$\frac{13}{45}$	$\frac{13}{45}$	$\frac{2}{3}$	$\frac{3}{8}$	$\frac{4}{5}$	C
D	$5\frac{5}{6}$	$4\frac{3}{10}$	$7\frac{1}{3}$	$4\frac{1}{6}$	$6\frac{3}{10}$	$3\frac{2}{3}$	$2\frac{1}{3}$	$1\frac{5}{8}$	$3\frac{1}{2}$	$4\frac{2}{3}$	$6\frac{1}{5}$	$1\frac{1}{8}$	$4\frac{1}{8}$	$4\frac{1}{4}$	$3\frac{3}{4}$	D

Exercises on the Table.

In each of the columns, 1, 2, 3, etc.,

- 1-15. Add A and B. 136-150. Multiply A by B.
 16-30. Add B and C. 151-165. Multiply B by C.
 31-45. Add C and D. 166-180. Multiply D by C.
 46-60. Add A, B, and C. 181-195. Multiply D by $2\frac{1}{2}$.
 61-75. Add B, C, and D. 196-210. Divide C by B.
 76-90. Add A, B, C, and D. 211-225. Divide D by 3.
 91-105. Take C from D. 226-240. Divide A by B.
 106-120. Take B from D. 241-255. Divide B by C.
 121-135. Take B + C from D. 256-270. Divide D by A.
 271-285. $C = \frac{3}{8}$ of what? 301-315. $A \times C = \frac{5}{8}$ of what?
 286-300. $D = \frac{8}{9}$ of what? 316-330. $4\frac{1}{2} \times D = \frac{7}{12}$ of what?

PART V. DECIMAL FRACTIONS.



173. If a thing is divided into 10 equal parts, what is each of the parts called? If one of these tenths is divided into 10 equal parts, what will each of these parts be called? What is $\frac{1}{10}$ of $\frac{1}{10}$? If one of these hundredths is divided into 10 equal parts what will each of these parts be called? What is $\frac{1}{10}$ of $\frac{1}{100}$?

174. Tenths, hundredths, thousandths, etc., are called **decimal fractions**.

175. To read and write decimal fractions.

One,	1.	The units above are written as in the margin, each unit of a lower order being expressed by writing the figure 1 one place further to the right.
One tenth,	0.1.	
One hundredth,	0.01.	
One thousandth,	0.001.	
One ten-thousandth,	0.0001.	

176. The dot used in writing decimals is called the **decimal point**.

177. The orders of decimal units are shown in the following

TABLE.

Units.	Decimal Point.	Tenths.	Hundredths.	Thousandths.	Ten-thousandths.	Hundred-thousandths.	Millionths.	etc.
2	.	7	4	3	8	9	6	

In which place at the right of the decimal point are hundredths written? thousandths? ten-thousandths? millionths?

What are written in the first place? in the fourth place?

178. The expressions 0.7, 0.74, 0.743 are simply other forms of writing $\frac{7}{10}$, $\frac{74}{100}$, $\frac{743}{1000}$, the numerator only being written while the denomination is expressed by the place of the right-hand figure in relation to the decimal point.

Hence to write a decimal: *Write the number as if it were an integral number, and then place the decimal point so that the right hand figure shall express the required denomination.*

To read a decimal: *Read the number as if it were an integral number, and then add the denomination of the units of the lowest order.*

NOTE. — In reading a decimal with an integral number, use the word "and" before the decimal.

179. Oral Exercises.

Read the following:

1.	2.	3.	4.
1.8.	0.405.	35.00564.	3333.3333.
5.18.	0.0405.	42.74822.	6258.6258.
0.518.	18.5472.	0.084567.	606.0606.

5. Turn to page 178 and read the numbers written in columns E and G.

180. Write in figures the following numbers :

6. 234 thousandths; 54 and 1666 ten-thousandths.

7. 10 and 582 thousandths; 83 ten-thousandths.

8. 74 hundred-thousandths; 5389 millionths.

9. 16 and 33 thousandths; 426243 millionths.

10. Six hundred forty-seven thousandths.

11. Six hundred and forty-seven thousandths.

12. Turn to page 178 and write the numbers given in column F.

13. Write in decimal form $6\frac{2}{10}$; $5\frac{86}{100}$; $\frac{67}{1000}$; $9\frac{9}{1000}$.

14. Write in decimal form $\frac{75}{10}$; $\frac{33\frac{1}{2}}{100}$. *Ans.* 7.5; $0.33\frac{1}{2}$.

15. Write in decimal form $\frac{48}{10}$; $\frac{87\frac{1}{2}}{100}$; $\frac{62\frac{1}{2}}{1000}$.

What are the denominators of the decimals 0.25? 0.025? 1.025? 3.0075? What are the numerators?

181. To change a decimal to lower denominations.

16. Change 5 to tenths; 0.7 to hundredths.

5 = 5.0, read 50 tenths;

0.7 = 0.70, read 70 hundredths.

To change a decimal to a lower denomination: *Annex zeros to the given expression till the place of the required denomination is filled.*

17. Change 6 to tenths; to hundredths; to thousandths.

18. Change 0.7 to thousandths; to millionths.

19. Change 6.7 to hundredths; 460 to tenths.

182. To change decimals to common fractions.

20. Change 0.5; 0.25; and $0.33\frac{1}{3}$, each to a common fraction in its simplest terms.

WRITTEN WORK.

$$0.5 = \frac{5}{10} = \frac{1}{2}.$$

$$0.25 = \frac{25}{100} = \frac{1}{4}.$$

$$0.33\frac{1}{3} = \frac{33\frac{1}{3}}{100} = \frac{100}{300} = \frac{1}{3}.$$

To change a decimal to a common fraction: *Write the decimal with its denominator, and then change the common fraction, if necessary, to its smallest terms.*

Change to common fractions in their smallest terms:

21. 0.2; 0.4; 0.05; 0.15; 0.25; 0.75.

22. 0.125; 0.375; 0.625; 0.875; 0.662.

183. To change common fractions to decimals.

Illustrative Example.—Change $\frac{3}{8}$ to a decimal.

WRITTEN WORK.

$$\begin{array}{r} 8 \overline{) 3.000} \\ 0.375 \end{array}$$

$\frac{3}{8}$ of 1 = $\frac{3}{8}$ of 3 (Art. 120). 3 equals 30 tenths, 300 hundredths, or 3000 thousandths. $\frac{3}{8}$ of 3000 thousandths is 0.375. *Ans.* 0.375.

To change a common fraction to a decimal: *Annex zeros to the numerator and divide by the denominator.*

184. Examples for Written Work.

Change

23. $\frac{1}{5}$ to 10ths. 27. $\frac{7}{20}$ to 100ths. 31. $\frac{3}{8}$ to 1000ths.

24. $\frac{3}{4}$ to 100ths. 28. $1\frac{1}{4}$ to 100ths. 32. $\frac{7}{8}$ to 1000ths.

25. $\frac{5}{8}$ to 1000ths. 29. $7\frac{1}{2}$ to 10ths. 33. $\frac{1}{5}$ to 100ths.

26. $\frac{1}{3}$ to 1000ths. 30. $\frac{1}{8}$ to 1000ths. 34. $\frac{5}{8}$ to 1000ths.

35. Change to a decimal form, $\$ \frac{1}{4}$; $\$ \frac{3}{20}$; $\$ \frac{4}{25}$; $\$ \frac{7}{50}$; $\$ \frac{7}{10}$.

36. Change to cents, $\$ \frac{3}{4}$; $\$ \frac{1}{8}$; $\$ \frac{1}{16}$; $\$ \frac{7}{8}$; $\$ \frac{1}{2}$; $\$ \frac{3}{4}$.

ADDITION OF DECIMALS.

Examples for Written Work.

185. Illustrative Example. — Write and add the following.

WRITTEN WORK.		To add decimals :
5 and 7 tenths,	5.7	<i>Add as in integers, placing the decimal point in the answer as soon as the tenths are added.</i>
13 and 8 tenths,	13.8	
9 and 14 hundredths,	9.14	
6 and 27 hundredths.	<u>6.27</u>	
<i>Ans.</i> 34.91		

37. Add 9 and 7 tenths, 76 and 8 tenths, 5 and 43 hundredths, and 24 and 9 hundredths.

38. Add 8 and 73 hundredths, 9 and 3 tenths, 67 and 34 hundredths, and 8 and 9 hundredths.

39. Add 7 and 29 hundredths, 46 and 7 tenths, 39 hundredths, 20 and 5 thousandths, and 7 tenths.

40. Add 5 and 236 thousandths, 18 and 37 thousandths, 246 and 21 hundredths, 581 thousandths, and 4 and 309 thousandths.

41. Add 1 and 326 thousandths, 648 and 25 hundredths, 37 and 98 hundredths, and 16 and 54 thousandths.

42. Add 5 and 456 thousandths, 27 and 2131 ten-thousandths, 6 and 35 ten-thousandths, 9 and 5 ten-thousandths, and 25 hundredths.

43. Add 15 and 3684 ten-thousandths, 5 and 95 hundredths, 6 and 864 thousandths, 16 and 58 hundredths, and 5847 ten-thousandths.

44. Add 9 and 1 hundredth, 59 ten-thousandths, 458 thousandths, 50 and 187 ten-thousandths, and 9 and 6 thousandths.

SUBTRACTION OF DECIMALS.

186. Examples for Written Work.

Illustrative Example. — From 2 and 75 hundredths take 928 thousandths.

WRITTEN WORK. To subtract decimals: *Subtract as in integers, placing the decimal point in the remainder as soon as the tenths are subtracted.*

2.75	
0.928	
Ans. <u>1.822</u>	

45. From 14 and 5 tenths take 75 hundredths.
46. From 7 and 43 hundredths take 647 thousandths.
47. From 675 thousandths take 497 thousandths.
48. Subtract 445 thousandths from 2 and 4 tenths.
49. Subtract 66 thousandths from 6 and 6 tenths.
50. Subtract 9 ten-thousandths from 9 hundredths.

Find the difference of the following :

51.	52.	53.	54.	55.	56.
4.075	75.09	10.066	0.202	27.9384	1.11
<u>2.439</u>	<u>7.446</u>	<u>0.0066</u>	<u>0.0202</u>	<u>3.42853</u>	<u>0.9999</u>

187. Examples in Addition and Subtraction.

57. A bottle of lemon syrup cost \$0.28, four pounds of sugar \$0.20, and three pounds of crackers \$0.25. How much did all cost?

58. Express decimally the sum of $\$ \frac{1}{2}$ and $\$ \frac{3}{4}$.

59. If from a side of leather weighing 15.4 pounds 7.875 pounds were cut, how many pounds remained?

60. A person having 307.5 acres of land, sold 11.08 acres. How many acres had he left?

61. How many acres of land must be added to 26.79 acres that the sum may equal 350 acres?

MULTIPLICATION OF DECIMALS.

188. To multiply a decimal by an integer.

Illustrative Examples.—Multiply 0.3 by 4; 0.03 by 4; 0.003 by 4.

WRITTEN WORK.			Three tenths multiplied by 4 is 12 tenths; three hundredths multiplied by 4 is 12 hundredths; three thousandths multiplied by 4 is 12 thousandths.
0.3	0.03	0.003	
$\begin{array}{r} 4 \\ \hline 1.2 \end{array}$	$\begin{array}{r} 4 \\ \hline 0.12 \end{array}$	$\begin{array}{r} 4 \\ \hline 0.012 \end{array}$	

In multiplying a decimal by an integer, how many places for decimals are pointed off in the product?

189. Examples for Written Work.

62. Multiply 0.4 by 9; 0.04 by 9; 0.004 by 9.
63. Multiply 1.2 by 12; 0.12 by 12; 0.024 by 12.
64. Multiply 7.5 by 15; 6.25 by 5; 87.5 by 20.
65. What is the cost of 5 pounds of butter at \$ 0.3 per pound? at \$ 0.4? at \$ 0.35? at \$ 0.40?
66. There are 16.5 feet in one rod. How many feet are there in a mile, or 320 rods?

190. To multiply an integer or a decimal by a decimal.

Illustrative Examples.—(1) Multiply 17 by 0.1; (2) multiply 17 by 0.3; (3) multiply 1.7 by 0.3.

WRITTEN WORK.		(1) To multiply 17 by 0.1 is to take 1 tenth of 17, which is expressed by placing the decimal point one place to the left.
(1) $17 \times 0.1 = 1.7$		
(2) $\begin{array}{r} 17 \\ 0.3 \\ \hline 5.1 \end{array}$	(3) $\begin{array}{r} 1.7 \\ 0.3 \\ \hline 0.51 \end{array}$	<i>Ans.</i> 1.7.
		(2) To multiply 17 by 0.3 is to take 3 tenths of 17. 1 tenth of 17 is 1.7 (17 tenths) and 3 tenths is 3 times 1.7, or 5.1. <i>Ans.</i> 5.1.
		(3) To multiply 1.7 by 0.3 is to take 0.3 of 1.7. 1 tenth of 1.7 is 0.17, and 3 tenths of 1.7 is 3 times 0.17, or 0.51. <i>Ans.</i> 0.51.

To multiply by decimals: *Multiply as in integers, and point off as many places for decimals in the product as there are decimal places in the multiplicand and multiplier counted together.*

191. Examples for Written Work.

67. Multiply 9 by 0.2; by 0.02; by 0.05.
 68. Multiply 12 by 0.6; by 0.08; by 0.008.
 69. Multiply 25 by 0.12; by 0.012; by 1.2.
- | | |
|---------------------------|------------------------------|
| 70. Multiply 11.6 by 4. | 77. $30.04 \times 0.105 = ?$ |
| 71. Multiply 1.16 by 7. | 78. $920.8 \times 706.1 = ?$ |
| 72. Multiply 17.07 by 11. | 79. $3.007 \times 0.005 = ?$ |
| 73. Multiply 106 by 0.3. | 80. $5005 \times 0.001 = ?$ |
| 74. Multiply 20 by 1.71. | 81. $88.04 \times 36 = ?$ |
| 75. Multiply 3.21 by 28. | 82. $0.825 \times 0.018 = ?$ |
| 76. Multiply 30.2 by 1.4. | 83. $0.0101 \times 4.16 = ?$ |
84. At \$0.62 $\frac{1}{2}$ (\$0.625) each for hats, what is the cost of 10 hats? of 2 dozen?
 85. At \$0.20 a square foot for land, what is the cost of 1000 square feet? of 2500 square feet?
 86. What is the cost of 12 $\frac{1}{2}$ yards of cloth at \$1.875 a yard?
 87. What must be paid for 100 feet of land at \$0.06 $\frac{1}{4}$ a foot? at \$0.33 $\frac{1}{3}$ a foot?
 88. There are 30.25 square yards in a square rod. How many square yards are there in 160 square rods, or an acre?
 89. At 0.3 of a cent per pound, what is the total cost of the following lots of ice: 357 lb., 900 lb., and 465 lb?
 90. If 1 pound of English money is worth \$4.8665, what is the value of 10.25 pounds?

DIVISION OF DECIMALS.

192. To divide a decimal by an integer.

What is 1 third of 0.6? 1 fourth of 0.08? 1 fifth of 0.025?

Illustrative Examples.—(1) What is 1 fourth of 10.272? (2) 1 eighth of 10.6? (3) $\frac{1}{7}$ of 31.2?

$$\begin{array}{r} \text{(1)} \\ \text{WRITTEN WORK.} \\ 4 \overline{)10.272} \\ \underline{2.568} \end{array}$$

$$\begin{array}{r} \text{(2)} \\ \text{WRITTEN WORK.} \\ 8 \overline{)10.6} \\ \underline{1.325} \end{array}$$

$$\begin{array}{r} \text{(3)} \\ \text{WRITTEN WORK.} \\ 7 \overline{)31.2} \\ \underline{4.457\frac{1}{7}} \\ \text{or } 4.457\ldots \end{array}$$

In example (1), thousandths being divided by 4, the answer is thousandths, so three places are pointed off as decimals.

In example (2), after dividing the tenths, there is a remainder (0.2); this is changed to hundredths and divided, leaving a remainder, 0.04, which is changed to thousandths and divided.

In example (3), after the division has been carried to thousandths, there is still a remainder, which may be changed to ten-thousandths and the division may be continued; or, *to show that the division is incomplete, dots may be written in the quotient.*

NOTE.—In the following examples, when the division is incomplete, the answers may be carried to thousandths.

In dividing a decimal by an integral number, *insert the decimal point in the quotient when the decimal point in the dividend is reached.*

193. Examples for Written Work.

91. Divide 6.24 by 12.

92. Divide 288.9 by 9.

93. Divide 91.05 by 15.

94. Divide 1.576 by 8.

95. Divide 112.84 by 5.

96. Divide 876.1 by 8.

97. Divide 112.84 by 11.

98. Divide 14.607 by 27.

99. Divide 13.47 by 17. 104. How many are $4321 \div 9$?
 100. Find $\frac{1}{8}$ of 157. 105. How many are $3214 \div 12$?
 101. Find $\frac{1}{8}$ of 879. 106. How many are $9486 \div 19$?
 102. Find $\frac{1}{4}$ of \$ 927. 107. How many are $9841 \div 21$?
 103. Find $\frac{1}{8}$ of \$ 721. 108. How many are $4936 \div 14$?
 109. If 8 chairs cost \$ 7, what is the cost of 1 chair ?
 110. If 4 woolen rugs cost \$ 78, what is the cost of 1 rug ?
 111. If 9 gallons of milk weigh 64.5 pounds, how many pounds will 1 gallon weigh ?
 112. A 5-franc piece of France is worth \$ 0.965. What is the value of 1 franc ?
 113. Eight florins of Austria equal \$ 3.858. What does 1 florin equal ?

194. To divide an integer or a decimal by a decimal.

How many times is 0.3 contained in 0.6 ? 0.4 in 0.8 ?

How many times is 0.03 contained in 0.09 ? 0.04 in 0.08 ?

Divide 0.006 by 0.002 ; 0.008 by 0.004 ; 0.012 by 0.006.

Illustrative Example. — (1) Divide 35 by 0.7 ;
 (2) 1.44 by 0.8.

In example (1), the dividend 35 is changed to 350 tenths, written 35.0. Dividend and divisor are

WRITTEN WORK.

$$\begin{array}{r} \text{(1)} \\ 0.7 \overline{)35.0} \\ \underline{50} \end{array} \quad \begin{array}{r} \text{(2)} \\ 0.8 \overline{)1.44} \\ \underline{1.8} \end{array}$$

now of the same denomination, tenths. 350 tenths divided by 7 tenths gives the same quotient as 350 divided by 7, which is 50. The vertical mark put after the tenths'

place in the dividend indicates where the decimal point comes below it in the quotient.

In example (2), the dividend 1.44 is equal to 14.4 tenths. This divided by 8 tenths gives the same quotient as 14.4 divided by 8, which is 1.8.

1. To divide decimals, *Divide as in integers. If the divisor is an integer, point off as many places for decimals in the quotient as there are decimal places in the dividend.*

2. *If the divisor is not an integer, place a mark in the dividend as many places to the right of the decimal point as there are decimal places in the divisor, and place a decimal point in the quotient when the terms of the dividend are used as far as the mark.*

NOTE. — When there is a remainder after all the terms of the dividend have been used, zeros may be annexed to the dividend, and the division may be continued.

195. Examples for Written Work.

114. Divide 315 by 0.7. 119. Divide 1000 by 0.001.

115. Divide 86.1 by 0.08. 120. Divide 90.09 by 0.071.

116. Divide 70.32 by 0.38. 121. Divide 8.64 by 71.6.

117. Divide 0.172 by 0.12. 122. Divide 538.1 by 4.001.

118. Divide 0.5307 by 0.1. 123. Divide 3.027 by 21.1.

124. How many tops at \$0.02 apiece can be bought for \$2?

125. How many rods, each 16.5 feet, are there in 100 feet?

126. At \$0.125 a quart for cherries, how many quarts can be bought for \$0.25? for \$0.875? for \$1.25? for \$3?

127. If an engine can run a mile in 1.5 minutes, how many miles can it run in an hour?

128. A meter equals 39.37 inches. How many meters of silk must I ask for in Paris to obtain 25 yards?

129. A cubic inch of statuary marble weighs 0.098 of a pound. How many cubic inches are there in a block which weighs 12.5 pounds?

196. DRILL TABLE. DECIMAL FRACTIONS.

(See Teacher's Key.)

Exam- ples.	E.	F.	G.	H.
1.	0.0516	Two, and 206 <i>thousandths</i> .	9.16	$1\frac{13}{25}$
2.	1.732	936 <i>ten-thousandths</i> .	800.1	$7\frac{1}{10}$
3.	8016.	54, and 54 <i>thousandths</i> .	0.0052	$\frac{13}{2500}$
4.	4.95	806, and 1047 <i>millionths</i> .	2.0763	$2\frac{7}{1000}$
5.	0.012	5 hundred, and 26 <i>hundredths</i> .	18.26 $\frac{1}{2}$	$18\frac{51}{100}$
6.	12.007	One thousand 6 <i>millionths</i> .	0.0101	$\frac{101}{10000}$
7.	45.9	Twenty-nine <i>millionths</i> .	3.0712	$3\frac{181}{2500}$
8.	8.621	846291 <i>hundred-thousandths</i> .	80.06	$80\frac{3}{50}$
9.	0.00562	Five hundred eleven <i>thousandths</i> .	5.4	$5\frac{2}{5}$
10.	1002.	4271, and 4271 <i>ten-millionths</i> .	0.6805	$\frac{1361}{2000}$
11.	1.87 $\frac{1}{2}$	68 thousand, and 4 $\frac{1}{2}$ <i>tenths</i> .	4.071	$4\frac{7}{1000}$
12.	0.12 $\frac{1}{2}$	One hundred 22 <i>thousandths</i> .	24.40	$24\frac{11}{25}$
13.	1.015	Eight, and 4 $\frac{1}{2}$ <i>hundredths</i> .	0.0002	$\frac{1}{5000}$
14.	8.33 $\frac{1}{3}$	Five hundred, and $\frac{2}{3}$ <i>tenths</i> .	1.071	$1\frac{71}{1000}$

Exercises on the Table.

1-14. Read the numbers expressed in E and in G.

15-28. Write in figures the numbers expressed in F.

29-42. Change E to equivalent common fractions in their lowest terms.

43-56. In the same way change G.

57-70. Change H to equivalent decimals (4 places). Add E, F, and G.

Find the difference between:

71-84. E and F. 85-98. E and G. 99-112. F and G.

113-126. Multiply E by F. 127-140. Multiply E by G.

141-154. Multiply F by G. 155-168. Divide E by F.

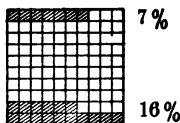
169-182. Divide G by E. 183-196. Divide G by F.

197-210. Add $E \times 10$, $F + 100$, and G.

PART VI.

PERCENTAGE.

197. Here is a square divided into 100 small squares. If the large square represents the whole of any thing or number, what part of the thing or number is represented by one of the small squares? by two of them? by three? by five? by ten? by twenty?

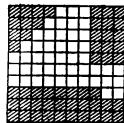


In the upper part of the large square, how many small squares are shaded? These are how many hundredths of the large square? In the lower part, how many hundredths are shaded? How many hundredths are shaded altogether?

198. Any part of a thing or number which is expressed as a number of hundredths of it is a **percentage**. In place of the word "hundredths," it is usual to employ the phrase **per cent**, or the sign %.

Thus, a percentage of the large square has been shaded in the upper part; another percentage in the lower part; and the sum of these two percentages is the percentage that has been shaded altogether. If we ask *what per cent* has been shaded, the answer is *seven per cent* (7%) in the upper part, *sixteen per cent* (16%) in the lower part, and *twenty-three per cent* (23%) altogether.

What per cent of this square is shaded in the upper left-hand corner? in the upper right-hand corner? in the lower part? What per cent of the square is not shaded? What per cent of the square would be shaded, if one half of the small squares were shaded? if one fourth of them were shaded? three fourths? one fifth? two fifths? three fifths? one tenth? two tenths? three tenths? seven tenths?



199. Oral Exercises.

1. What per cent of a thing is $\frac{1}{2}$ of it? $\frac{1}{4}$? $\frac{3}{4}$? $\frac{1}{5}$? $\frac{2}{5}$? $\frac{4}{5}$? $\frac{1}{10}$? $\frac{2}{10}$? $\frac{3}{10}$? $\frac{4}{10}$? $\frac{7}{10}$? $\frac{9}{10}$?

2. What per cent of a thing is the whole of it? The whole of it and fifty per cent more? The whole of it and twenty-five per cent more?

3. What per cent of a thing is $\frac{1}{2}$ of it? $\frac{2}{3}$ of it? $\frac{3}{4}$ of it?

4. What per cent of a thing is $\frac{3}{4}$ of it? $\frac{4}{5}$ of it? $\frac{5}{6}$ of it? $\frac{7}{8}$ of it?

5. What per cent of a thing is $\frac{4}{5}$ of it? $\frac{5}{6}$ of it? $\frac{6}{7}$ of it? $\frac{7}{8}$ of it? $\frac{8}{9}$ of it?

6. What per cent of a thing is $\frac{1}{10}$ of it? $\frac{7}{10}$ of it? $\frac{11}{10}$ of it? $\frac{17}{10}$ of it?

Draw a square, divide it into 100 equal small squares, and shade one third of them. How many small squares and what part of another have you shaded? How many are not shaded?

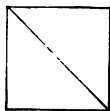
7. What per cent of a thing is $\frac{1}{3}$ of it? $\frac{2}{3}$ of it? $\frac{3}{4}$ of it? $\frac{5}{8}$ of it?

How many of the 100 small squares, and what part of another, have you shaded when you have shaded $\frac{1}{4}$ of them? $\frac{5}{8}$ of them? $\frac{1}{12}$ of them? $\frac{5}{12}$ of them? $\frac{1}{3}$ of them? $\frac{2}{3}$ of them? $\frac{3}{4}$ of them? $\frac{7}{8}$ of them?

8. What per cent of a thing is $\frac{1}{6}$ of it? $\frac{5}{6}$ of it?

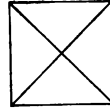
9. What per cent of a thing is $\frac{1}{12}$ of it? $\frac{3}{12}$ of it? $\frac{5}{12}$ of it? $\frac{7}{12}$ of it? $\frac{11}{12}$ of it?

10. What per cent of a thing is $\frac{1}{8}$ of it? $\frac{3}{8}$ of it? $\frac{5}{8}$ of it? $\frac{7}{8}$ of it?

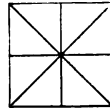


11. A square is divided by a diagonal into two equal triangles. What per cent of the square is covered by each triangle?

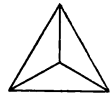
12. A square is divided by two diagonals into four equal triangles. What per cent of the square is covered by each triangle? by two of them? by three? by four?



13. Here is a square divided into eight equal triangles. Each triangle is what per cent of the square?



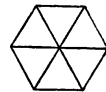
14. Here is an equal-sided (equilateral) triangle divided into three equal triangles by lines drawn from the center to the corners. What per cent of the larger triangle is each smaller one? Two of the smaller ones cover what per cent of the larger one?



15. Here is a regular pentagon* divided into five equal triangles by lines drawn from the center to the corners. What per cent of the pentagon is covered by one triangle? by two? three? four? five?



16. Here is a regular hexagon divided into six equal triangles. What per cent of the hexagon is covered by one triangle? by two? three? four? five? six?



To what common fractions are the following per cents equal?

- | | | | | |
|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
| 17. 50% | 21. 25% | 25. $12\frac{1}{2}\%$ | 29. $33\frac{1}{3}\%$ | 33. $16\frac{2}{3}\%$ |
| 18. 10% | 22. $8\frac{1}{3}\%$ | 26. $6\frac{1}{4}\%$ | 30. 5% | 34. 4% |
| 19. 75% | 23. $37\frac{1}{2}\%$ | 27. $62\frac{1}{2}\%$ | 31. $87\frac{1}{2}\%$ | 35. $66\frac{2}{3}\%$ |
| 20. $83\frac{1}{3}\%$ | 24. 20% | 28. 80% | 32. 70% | 36. 90% |

* Called a *regular* pentagon, because all its sides are equal and all its angles are equal.

To what improper fractions are the following per cents equal?

37. 150% 39. 125% 41. 175% 43. 100% 45. 160%
 38. $133\frac{1}{3}\%$ 40. $137\frac{1}{2}\%$ 42. $166\frac{2}{3}\%$ 44. $162\frac{1}{2}\%$ 46. $183\frac{1}{3}\%$

200. Any per cent may be expressed as a common fraction with the denominator 100, or as a decimal fraction. The latter form is the more usual.

Thus,

- 1 per cent, 1 %, may be expressed $\frac{1}{100}$, or 0.01.
 7 per cent, 7 %, may be expressed $\frac{7}{100}$, or 0.07.
 38 per cent, 38 %, may be expressed $\frac{38}{100}$, or 0.38.
 $62\frac{1}{2}$ per cent, $62\frac{1}{2}\%$, may be expressed $\frac{62\frac{1}{2}}{100}$, or 0.625.
 $83\frac{1}{3}$ per cent, $83\frac{1}{3}\%$, may be expressed $\frac{83\frac{1}{3}}{100}$, or $0.83\frac{1}{3}$.
 100 per cent, 100 %, may be expressed $\frac{100}{100}$, or 1.00.
 125 per cent, 125 %, may be expressed $\frac{125}{100}$, or 1.25.
 $\frac{1}{2}$ of 1 per cent, $\frac{1}{2}\%$, may be expressed $\frac{\frac{1}{2}}{100}$, or 0.005.

Express the following per cents in the decimal form:

- | | | | | |
|-------------------|-------------------|-------------------|-------------------|-------------------|
| 2% | 8% | 4% | 9% | 12% |
| 15% | 63% | 75% | 86% | 94% |
| $12\frac{1}{2}\%$ | $28\frac{1}{2}\%$ | $18\frac{3}{4}\%$ | $58\frac{1}{3}\%$ | $41\frac{2}{3}\%$ |

201. To find a percentage of a number.

Illustrative Example. — What is 8% of \$300?

SOLUTION. — 1% of \$300 is \$3; and 8% is 8 times \$3, or \$24.

Ans. \$24.

202. Oral Exercises.

1. What is 7% of \$800? of 600 bushels? of 400 tons? of 300 miles?
2. What is 12% of \$500? of 200 acres? of 900 boys? of 600 trees?
3. What is 4% of 300 miles? of 700 cents? of 1200 horses? of 2000 pounds?
4. What is 1% of 800 cords of wood? 2%? 5%?
5. What is 1% of 700 gallons of oil? 3%? 8%?
6. What is 1% of 1500 tons of coal? 4%? 10%?
7. What is 1% of 987 pounds? of 520 feet?
8. What is 1% of \$944? of \$38.70?
9. What is 2% of \$3000? of 4000 feet?
10. What is 3% of \$4000? of 6000 bushels?
11. What is 5% of 2000 yards? of 5000 gallons?
12. What is 6% of \$50? of \$70? of \$80?
13. What is 8% of \$20? of \$40? of \$60?
14. What is 10% of \$10? of \$80? of \$90?
15. What is 10% of \$75? of \$84? of \$97?
16. What is 20% of \$35? of \$55? of 75?
17. What is 30% of 10 rods? of 80 miles?
18. What is 40% of 25 ounces? of 50 cents?
19. What is 50% of 200 square feet? of 100 acres?
20. What is 100% of \$50? of \$100? of \$1000?
21. What is $12\frac{1}{2}\%$ of \$72? of \$80? of \$96?
22. What is $62\frac{1}{2}\%$ of \$16? of \$48? of \$100?
23. What is $33\frac{1}{3}\%$ of 3 miles? of 63 days?
24. What is 125% of \$24? of \$36? of \$48?
25. What is $137\frac{1}{2}\%$ of \$64? of \$80? of \$88?
26. Find 3% of \$7, of \$10, of \$12, of \$20.
27. Find 5% of \$5, of \$6, of \$10, of \$20.
28. Find 6% of \$4, of \$8, of \$12.

203. Illustrative Example. — What is 8% of \$923?

WRITTEN WORK. 1% of \$923 is \$9.23; and 8% is 8 times \$9.23
 923 or \$73.84. In this process we have first divided
 0.08 by 100, and then multiplied the quotient by 8.
 73.84 But the result is the same if we reverse these
 steps, first multiplying by 8 and then dividing
 the product by 100, as is done in the written work. This is in
 fact multiplying by 0.08. *Ans.* \$73.84.

To find a percentage of a number: *Multiply it by the per cent expressed as a decimal.*

204. Examples for Written Work.

1. What is 15% of \$594?
2. What is 35% of \$982.50?
3. What is 85% of 9580 gallons?
4. Find 27% of 250 tons of coal.
5. Find 7% of 316 pounds of copper.
6. Find $62\frac{1}{2}\%$ of \$6000.
7. A grain dealer bought 9420 bushels of corn, and next day sold 25% of it. How many bushels did he sell?
8. During a severe winter a ranchman lost 65% of his herd of cattle. If he had 25,000 cattle in the fall, how many had he left in the spring?
9. A mechanic who earns \$1800 a year spends 75% of this for himself and family, 5% for charity and pleasures, and saves the rest. How many dollars does he save?
10. The value of a house is \$5500, and the tenant pays $8\frac{1}{2}\%$ of this sum for rent and taxes. How many dollars does he pay?

11. A dealer bought coal at \$4.25 per ton, and sold it so as to gain 28%. At what price did he sell?

12. From a cargo of 28,960 gallons of molasses $6\frac{1}{2}\%$ was lost by leakage. How many gallons were lost?

13. Which is the greater, and how much, 5% of \$2346 or 6% of \$1995?

14. Find the difference between $62\frac{1}{2}\%$ of \$598 and $87\frac{1}{2}\%$ of \$642.

15. Find the sum of $16\frac{2}{3}\%$ of \$894, $8\frac{1}{3}\%$ of \$492, and $66\frac{2}{3}\%$ of \$525.

16. A housekeeper bought at one time supplies to the amount of \$349.60, but 5% of the bill was thrown off for cash payment. How much remained to be paid?

17. If the ore of a silver mine yields $11\frac{1}{2}\%$ of pure silver, how many pounds of pure silver are obtained from one ton (2240 pounds) of ore?

18. A farmer bought 50 tons of hay at \$15 per ton in November. The next February, when the price had risen 40%, he sold it. How many dollars did he gain on one ton? on the whole?

19. A lot of barley bought at 45¢ was afterwards damaged and so was sold for $37\frac{1}{2}\%$ less than cost. How much was lost on the whole lot of 16,000 bushels?

20. A lot of pineapples which cost \$540 was sold so that the gain on one half of them was 30% and on one third of them 40%; but on the remainder there was a loss of 50%. How much was the gain on the whole?

21. A merchant purchased 1200 yards of cloth at 8¢ per yard. He sold 20% of it at a price 25% above cost, 30% of it at $37\frac{1}{2}\%$ above cost, and the rest of it at $18\frac{3}{4}\%$ above cost. At what prices per yard did he sell? How much did he gain on the whole?

205. To find a number when a percentage of it is given.

If 5% of my money is \$35, how much money have I?

SOLUTION.—If 5% of my money is \$35, 1% is $\frac{1}{5}$ of \$35, which is \$7; and 100%, or the whole, is 100 times \$7, or \$700.

Ans. \$700.

206. Oral Exercises.

1. \$45 is 5% of how much money?
2. \$32 is 8% of how much money?
3. \$65 is 10% of how much money?
4. 80 tons is $\frac{1}{4}$ % of how much coal?
5. 35 days is 7% of how many days?
6. 63 miles is 9% of what distance?
7. A farmer sold 50 bushels of potatoes, which was 25% of all the potatoes he had. How many bushels had he?
8. In an orchard 12% of the trees are pear trees. If there are 96 pear trees, how many trees are there in the orchard?
9. A man borrowed money and paid 6% for the use of it one year. How much money did he borrow, if he paid \$72 for the use of it?
10. A house was sold through a real estate agent who charged 2% for his services. What was the price of the house, if the broker received \$60?

207. Illustrative Example.—If 5% of my money is \$97.85, how much money have I?

WRITTEN WORK. If 5% is \$97.85, 1% is $\frac{1}{5}$ of \$97.85, or \$19.57, and 100% is 100 times \$19.57, which is \$1957. This is dividing by 5 and multiplying the quotient by 100; which is the same as dividing by 0.05, as is done in the written work.

$$\begin{array}{r} 0.05 \overline{)97.85} \\ \underline{1957} \end{array}$$

Ans. \$1957.

To find a number from a given percentage of it:
Divide the percentage by the per cent expressed as a decimal.

208. Examples for Written Work.

1. If 8% of a man's money is \$498.96, how much money has he?

2. \$1477.50 is 15% of how much money?

3. 3136 pounds is 35% of how much weight?

4. 405 feet is 18% of what distance?

5. \$12.65 is $27\frac{1}{2}\%$ of how much money?

6. The rent of a store is fixed at $9\frac{1}{2}\%$ of its cost to build. How much did it cost to build, if the rent is \$7125?

7. After the wages of the men in an iron foundry had been cut down 8%, they received \$18.40 per week. How much did they receive before the reduction?

NOTE.— What they received after the reduction was 100% less 8%, or 92% of what they received before the reduction.

8. After the wages of the girls in a cotton factory had been cut down 10%, they received \$8.64 per week. How much did they receive before the cut?

9. After losing 23% of his sheep, a ranchman has 1848 sheep left. How many had he at first?

10. A house was sold for \$3500, which was $12\frac{1}{2}\%$ less than it cost to build. How much did it cost to build?

11. A piano was sold for \$375, which was 25% more than it cost. How much did it cost?

NOTE.— The price received was 100% + 25%, or 125% of the cost.

12. A pair of horses was sold for \$516, which was an advance of 20% on the cost. How much did the horses cost?

13. A boy is 15 years old, and his age is 25% greater than that of his brother. How old is the brother?

14. A tree which has increased in height 17% in three years is now 58.5 feet high. How high was it three years ago?

15. A dealer sold coal at 130% of its cost and gained \$1.20 per ton. How much did the coal cost?

16. \$862.50 is 115% of how much money?

17. \$500 is 125% of how much money?

18. \$289.80 is $112\frac{1}{2}\%$ of what sum of money?

19. 960 bushels is 120% of how much wheat?

20. 630 acres is 140% of how much land?

21. A boy, after increasing 5% in weight, weighed 134.4 pounds. How much did he weigh before?

22. 3720 is 25% more than what number?

23. 507 is 35% less than what number?

24. A broker charged $\frac{1}{8}\%$ for selling certain railroad shares, valued at \$100 each. How many shares did he sell, if he was paid \$7.50?

25. A man pays $2\frac{1}{2}\%$ on the value of his house for insurance. How much is his house valued at, if the amount paid for insurance is \$135?

26. A man having a certain sum of money gained a sum equal to 50% of it, and then lost 50% of what he had. If he had \$600 left, how much had he at first?

27. A dealer added 30% to the cost of beef to make his asking price, but reduced his asking price 10% to make a sale. If he sold the beef for \$23.40 per bbl., how much did it cost him?

209. To find what per cent one number is of another.

What per cent of 25 is 8?

SOLUTION. — 8 is $\frac{8}{25}$ of 25; and $\frac{8}{25} = \frac{32}{100}$, or 32%. *Ans.* 32%.

210. Oral Exercises.

1. What per cent of 25 is 12? 4? 7? 20?
2. What per cent of 50 is 12? 16? 9? 32?
3. What per cent of 5 is 2? 3? 4?
4. What per cent of 15 is 3? 9? 5? 10?
5. If sugar is bought at 5¢, and sold at 7¢ a pound, what per cent is gained?
6. What per cent of 36 pounds is 9 pounds?
7. What per cent of 20 gallons is 15 gallons?
8. Losing 7 vines out of every 20 is losing what per cent?
9. If oranges are bought at \$4 and sold at \$3 a box, what per cent is lost?
10. What per cent of 80 is 40? 80? 120?
11. What per cent of \$200 is \$150? \$250?
12. What per cent of 1000 is 100?
13. What per cent of 100 is 1000?

211. Illustrative Example. — What per cent of \$75 is \$37½?

WRITTEN WORK.

$$\begin{array}{r} 750 \overline{)375.00} (0.50 \\ \underline{3750} \\ 0 \end{array}$$

$$37\frac{1}{2} \text{ is } \frac{37\frac{1}{2}}{75} \text{ or } \frac{375}{750} \text{ of } 75;$$

$$\frac{375}{750} = 0.50 \text{ or } 50\%.$$

Ans. 50%.

To find what per cent one number is of another:
Divide the former by the latter, carrying the division to hundredths.

212. Examples for Written Work.

1. What per cent of \$150 is \$25.50?
2. What per cent of \$938.50 is \$154.85 $\frac{1}{4}$?
3. From casks containing 240 gallons of molasses, 18 gallons leaked out. What per cent of the molasses was thus lost?
4. At school James spelled correctly 236 words out of the 250 that were given to be spelled. What per cent did he spell correctly? His sister missed only 4 words out of the 250. What per cent did she spell correctly?
5. What per cent a year is paid for the use of money when \$34.80 is paid for the use of \$580 for one year?
6. What per cent a year is paid for the use of money when \$5.25 is paid for the use of \$420 for three months?
7. The number of pupils in the first grade of a school is 114; in the second, 86; in the third, 65; and in the fourth, 45. What per cent of all the pupils are in each grade?
8. To what per cent is the fraction $\frac{171}{225}$ equal?

WRITTEN WORK. The fraction $\frac{171}{225}$ changed to hundredths (Art. 183) is 0.76, which is 76%. *Ans.* 76%.

225)171.00(0.76

157 5
13 50
13 50

NOTE. — The answer would be the same if the question were, what per cent of the denominator is the numerator of the fraction $\frac{171}{225}$.

9. To what per cent is the fraction $\frac{8}{40}$ equal?
10. To what per cent is the fraction $\frac{5}{30}$ equal?
11. To what per cent is the fraction $\frac{17}{250}$ equal?
12. To what per cent is the fraction $\frac{37}{50}$ equal?

213. Applications of Percentage.

1. A carriage which cost \$350 was sold for 10 % above cost. How much was the profit?
2. At what price must coffee which cost 15¢ a pound be sold to make a profit of 20 %?
3. Cloth which cost \$1.20 a yard is sold at a profit of 35 %. At what price is it sold?
4. A horse which cost \$225 was sold for 25 % less than cost. How much was the loss?
5. A dealer bought 200 pairs of shoes for \$350. At what price must he sell them a pair to gain 20 %?
6. What per cent profit is made on butter bought at 23¢ and sold at 28¢ per lb.?
7. A piano was bought for \$500 and sold for \$420. What per cent was lost?
8. By buying beef at \$12 and selling it at \$15 per bbl., what per cent is gained?
9. What per cent is lost by buying beef at \$15 and selling at \$12 per bbl.?
10. A piece of land was sold at an advance of 45 % on the cost. If it was sold for \$2610, how much did it cost?
11. A house was sold for \$3500 at a loss of 30 % on the cost. How much did the house cost?
12. By selling two cows at \$72 each, I gained 20 % on one and lost 20 % on the other. How much did the cows cost? Which was greater, my gain or my loss?
13. By selling lumber at \$27.60 per thousand, there is a profit of 15 %. How much did the lumber cost?
14. By selling a lot of wheat at 15 % profit, a dealer gained \$83.70. How much did the wheat cost?

15. An agent was employed to purchase cotton, and was paid $1\frac{1}{4}\%$ on the amount of his purchases. How much was he paid for purchasing \$8500 worth of cotton?

16. An auctioneer who charges for his services a commission of 5% on his sales sells furniture to the amount of \$1352.75. How much does his commission amount to?

17. A commission merchant sells 4200 yards of cloth at $7\frac{1}{4}\text{¢}$ per yard. How much is his commission at $2\frac{1}{2}\%$?

18. A real estate broker whose commission is 4% receives \$260 for selling a farm. For what price was the farm sold?

19. After allowing 15% to a collection agent for collecting a debt, I received the balance, \$374. How much was the debt?

20. A bill for hardware amounting to \$128.75 was reduced by taking off 20%. How much remained to be paid?

NOTE. — Such a reduction is called **trade discount**, or simply **discount**.

21. What remains to be paid on a bill for books amounting to \$528.50 after a discount of 15% has been made?

NOTE. — What remains to be paid on a bill after a discount has been made is called the **net amount** of the bill.

22. What is the net amount of a bill of \$515 for goods sold subject to trade discounts of 20%, 10%, and 5% for cash?

NOTE. — This means that a discount of 20% is first made from the amount of the bill; then from the remainder a discount of 10% is made; and finally from the last remainder a discount of 5% is made. These are **successive** discounts.

23. A bill for goods amounting to \$1569 is reduced to what net amount by successive discounts of 20 %, 10 %, and 5 % ?

24. A retail dealer in furniture bought furniture to the amount of \$5500, subject to trade discounts of 30 % and 10 %, and 5 % off for cash. How much did his furniture cost him ?

25. At list prices a bill for hardware amounts to \$632.50. What is the net amount after discounts of 40 %, 10 %, and 5 % ?

26. How much better for the buyer is it to have a discount of 35% upon a bill of \$100 worth of goods than to have successive discounts of 20%, 10%, and 5% ?

What per cent is gained or lost

27. By buying at \$40 and selling at \$50 ?

28. By buying at \$50 and selling at \$40 ?

29. By buying at \$50 and selling at \$60 ?

30. By buying at \$60 and selling at \$50 ?

31. A lot of wood was sold for \$943 at a profit of 15 %. For how much should it have been sold to make a profit of 25 % ?

32. Goods in a store valued at \$35,000 are insured for $\frac{4}{5}$ of their value at $1\frac{3}{4}$ % premium. How much is the premium ?

NOTE.—Premium is the price paid for insurance. It is reckoned as a percentage on the amount insured.

33. For insuring the books and furniture in my house, valued by the insurer at \$1800, a premium of $\frac{3}{8}$ of one per cent ($\frac{3}{8}$ %) is paid. How much does the insurance cost me ?

34. A factory and machinery are insured for \$120,000 at $3\frac{1}{4}\%$. What is the cost of the insurance?

35. A lot of wool which cost \$3000 is insured for $\frac{2}{3}$ of its value at $1\frac{1}{4}\%$. If the wool should be totally destroyed by fire, how much would the owner lose, including the amount paid for insurance?

36. The tax rate in a certain town is \$13.40 on \$1000. What per cent is this? A man living in this town pays taxes on a house and land valued at \$5400. How much is his tax bill?

37. A tax rate of $1\frac{3}{8}\%$ is a rate of how many dollars and cents on one thousand dollars?

38. At \$12.70 on a thousand, how much must be paid for taxes on property valued at \$6950?

39. A jeweler imported jewelry valued at \$5250, upon which he paid at the custom house duties at the rate of 35%. How much did the duties amount to?

40. A merchant imported carpets from England, paying duties at the custom house in New York at the rate of 40%. The carpets cost 250 pounds sterling. How much did the duties amount to, the pound sterling being equal to \$4.8665?

41. Three men together bought a piece of woodland, agreeing to share profits in proportion to the money each paid. A paid \$340, B paid \$300, and C paid \$360. What per cent of the whole did each pay? By cutting and selling the wood they gained \$540. What was each man's share of the profits?

42. A certain sum of money is to be divided among three children in proportion to their ages, which are 6 years, 9 years, and 10 years. What per cent of the whole sum will each child receive?

PART VII.

INTEREST.

214. I borrowed \$300, and had the use of it in my business for one year. At the end of the year I paid back the \$300, together with 6% of \$300 for the use of it. How much did I pay for the use of the money? How much in all? *Ans.* \$18 for the use; \$318 in all.

215. The price paid for the use of money is **interest**. The money for the use of which money is paid is the **principal**.

216. The **rate of interest** is the fraction which one year's interest is of the principal. This fraction is usually expressed as a **per cent** or as a **decimal**.

Thus, in the example, \$300 is the principal, \$18 is the interest, and 6% is the rate.

Interest for Years.

217. Illustrative Example. — What is the interest of \$536 for three years at 6% per annum (a year)?

WRITTEN WORK.

(1)	(2)
Principal, \$536	\$536
0.06	0.18
<u>\$32.16</u>	<u>4288</u>
3	536
<u>\$96.48</u>	<u>\$96.48</u>

(1) One year's interest is found by multiplying the principal by the rate. The result is \$32.16. Three years' interest is found by multiplying one year's interest by 3. *Ans.* \$96.48.

(2) The rate for one year is 0.06, and the rate for three years is 3 times this, or 0.18. Multiplying the principal by this gives the interest for three years. *Ans.* \$96.48.

218. At 6% per annum, what part of the principal is the interest for 2 years? for 3 years? for 6 years? for 9 years? for any number of years?

At 6% per annum, the interest for any number of years is 6 times as many hundredths of the principal as there are years.

219. Examples for Written Work.

At 6% per annum, what is the interest

1. Of \$423 for 2 years? 6. Of \$139.50 for 4 years?
2. Of \$916 for 4 years? 7. Of \$263.50 for 3 years?
3. Of \$587 for $5\frac{1}{2}$ years? 8. Of \$1385.75 for $1\frac{1}{2}$ years?
4. Of \$698 for $2\frac{3}{4}$ years? 9. Of \$2394.63 for 5 years?
5. Of \$1280 for $3\frac{1}{8}$ years? 10. Of \$4289.28 for $4\frac{1}{2}$ years?

Interest for Months.

220. Illustrative Example. — At 6% per annum, what is the interest of \$628 (1) for 2 months? (2) for 8 months? (3) for 7 months?

WRITTEN WORK.

(1) Principal, \$628

Interest, \$6.28

(2) Principal, \$628

Interest, $\begin{array}{r} 4 \\ \hline \$25.12 \end{array}$

(3) Principal, \$628

Interest, $\begin{array}{r} 7 \\ \hline 2) \$4396 \\ \$21.98 \end{array}$

(1) The rate for 2 months, or $\frac{1}{6}$ of a year, is $\frac{1}{6}$ of 6%, or 1%; and 1% of the principal is found by moving the decimal point two places to the left. *Ans.* \$6.28.

(2) The interest for 8 months is 4 times the interest for 2 months. Multiplying the principal by 4 and then moving the decimal point of the product two places to the left, gives the same result as finding 2 months' interest and multiplying that by 4. *Ans.* \$25.12.

(3) The interest for 7 months is $3\frac{1}{2}$, or $\frac{7}{2}$, times the interest for 2 months.

Ans. \$21.98

221. The interest for 2 months being 1%, or 0.01 of the principal, what part of the principal is the interest for 4 months? for 6 months? for 8 months? for 3 months? for 7 months? for 9 months? for any number of months?

At 6% per annum, the interest for any number of months is one half as many hundredths of the principal as there are months.

222. Examples for Written Work.

At 6% a year, or 1% for 2 months, find the interest

- | | |
|-----------------------------------------------------------------------|-----------------------------------|
| 11. Of \$460 for 2 mo. | 20. On \$224.75 for 1 mo. |
| 12. Of \$694 for 8 mo. | 21. On \$864.88 for 16 mo. |
| 13. Of \$525 for 10 mo. | 22. On \$369.48 for 4 mo. |
| 14. Of \$1389 for 14 mo. | 23. On \$5000 for 6 mo. |
| 15. Of \$3900 for 22 mo. | 24. On \$982.16 for 18 mo. |
| 16. Of \$8000 for 7 mo. | 25. On \$587.62 for 3 mo. |
| 17. Of \$98.50 for 9 mo. | 26. On \$328.19 for 13 mo. |
| 18. Of \$4630 for 5 mo. | 27. On \$633.45 for 15 mo. |
| 19. Of \$5000 for 11 mo. | 28. On \$928.67 for 17 mo. |
| 29. At 6% a year, what is the interest on \$428 for 20 months? | |

SOLUTION.—Since the interest for 2 months is 1%, for 20 months it is 10%; and 10%, or 0.1, of the principal is found by moving the decimal point one place to the left. *Ans.* \$42.80.

Some examples are easily worked by finding first the interest for 20 months, and then finding fractional parts of that for aliquot parts of 20 months.

At 6% a year, what is the interest

- | | |
|----------------------------------------------|----------------------------------------------|
| 30. On \$1440 for 4 mo.? | 34. On \$625.80 for 10 mo.? |
| 31. On \$2584 for 5 mo.? | 35. On \$832.50 for 25 mo.? |
| 32. On \$6294 for $6\frac{2}{3}$ mo.? | 36. On \$163.20 for 15 mo.? |
| 33. On \$3726 for $3\frac{1}{2}$ mo.? | 37. On \$3580 for $7\frac{1}{2}$ mo.? |

Interest for Days at 6%.

223. Illustrative Example.—At 6% per annum, what is the interest (1) of \$4800 for 6 days? (2) of \$726.50 for 23 days.

WRITTEN WORK.

(1)
Principal, \$4800
Interest, \$4.800

(2)
Principal, \$726.50
23
217950
14530
6) \$16.70950
Interest, \$2.78

the product is divided by 6.

(1) The rate for 60 days (2 months) being 0.01, the rate for 6 days is $\frac{1}{10}$ of 0.01, or 0.001. One thousandth of the principal is found by moving the decimal point three places to the left. *Ans.* \$4.80.

(2) The interest for 23 days might be found by first finding the interest for 6 days (moving the decimal point), then dividing that interest by 6, and multiplying the quotient by 23. But it usually takes fewer figures to reverse the order of these steps, and the result is the same. So the principal is multiplied by the number of days, 23, the decimal point is moved three places to the left, and *Ans.* \$2.78.

224. The interest for 6 days being 0.001 of the principal, what part of the principal is the interest for 12 days? for 18 days? 24 days? 15 days?

At 6% per annum, the interest for any number of days is one sixth as many thousandths of the principal as there are days.

225. Examples for Written Work.

At 6% a year, or 0.001 for 6 days, find the interest

38. On \$520 for 6 days. 42. On \$487 for 15 days.
39. On \$394 for 18 days. 43. On \$728 for 33 days.
40. On \$500 for 12 days. 44. On \$834 for 63 days.
41. On \$1000 for 24 days. 45. On \$955 for 93 days.

At 6% a year, or 0.001 for 6 days, find the interest

46. On \$412.66 for 1 d. 50. On \$967.50 for 11 d.
 47. On \$928.75 for 2 d. 51. On \$629.75 for 13 d.
 48. On \$536.75 for 3 d. 52. On \$842.90 for 25 d.
 49. On \$5485.95 for 5 d. 53. On \$589.60 for 53 d.

Interest for Years, Months, and Days at 6%.

226. Illustrative Example. — At 6% per annum, what is the rate (1) for 3 years 10 months and 18 days? (2) for 2 years 5 months and 23 days?

(1)

The rate for 3 y. = 0.18
 for 10 mo. = 0.05
 for 18 d. = 0.003
 Ans. 0.233

(2)

The rate for 2 y. = 0.12
 for 5 mo. = 0.025
 for 23 d. = 0.003 $\frac{5}{8}$
 Ans. 0.148 $\frac{5}{8}$

227. Illustrative Example. — What is the interest of \$532 for 2 years 7 months and 17 days at 6% per annum?

WRITTEN WORK.

The rate	Principal, \$532
for 2 y. = 0.12	0.157 $\frac{5}{8}$
for 7 mo. = 0.035	6)2660
for 17 d. = 0.002 $\frac{5}{8}$	443 $\frac{5}{8}$
for the whole time = 0.157 $\frac{5}{8}$	3724
	2660
	532
	Interest, \$83.967 $\frac{1}{4}$

The rate for the whole time is 0.157 $\frac{5}{8}$; that is, the interest is 0.157 $\frac{5}{8}$ of the principal. Multiplying the principal by 0.157 $\frac{5}{8}$ gives the interest. The first step in multiplying is to multiply by $\frac{5}{8}$, which is done by multiplying by 5 and dividing by 6, as shown in the written work above.

Ans. \$83.97.

228. From the foregoing examples is derived the

Rule.

To compute interest for years, months, and days at 6%: *Add together six times as many hundredths as there are years, one half as many hundredths as there are months, and one sixth as many thousandths as there are days, and by the decimal so found multiply the principal.*

229. Examples for Written Work.

At 6% a year, find the interest

- 54. On \$325 for 1 y. 4 mo. 18 d.
- 55. On \$892 for 3 y. 6 mo. 27 d.
- 56. On \$96.50 for 2 y. 8 mo. 3 d.
- 57. On \$48.13 for 1 y. 3 mo. 9 d.
- 58. On \$5928 for 2 y. 1 mo. 8 d.
- 59. On \$7500 for 3 y. 5 mo. 25 d.
- 60. On \$830 for 2 y. 10 mo. 20 d.
- 61. On \$6000 for 1 y. 7 mo. 19 d.
- 62. On \$5500 for 4 y. 11 mo. 17 d.
- 63. On \$138.96 for 3 y. 9 mo. 29 d.

230. The sum of the principal and the interest is called the **amount**.

231. Examples for Written Work.

At 6% a year, find the amount

- | | |
|------------------------------|--------------------------------|
| 64. Of \$700 for 3 years. | 69. Of \$230 for 16 days. |
| 65. Of \$9000 for 2 y. 6 mo. | 70. Of \$94.60 for 93 days. |
| 66. Of \$300 for 11 mo. | 71. Of \$88.15 for 10 mo. 5 d. |
| 67. Of \$400 for 1 y. 7 mo. | 72. Of \$934 for 4 mo. 3 d. |
| 68. Of \$50,000 for 3 mo. | 73. Of \$869.50 for 41 days. |

At 6% a year, find the amount

74. Of \$533 for 2 y. 4 mo. 18 d.
75. Of \$928 for 3 y. 7 mo. 12 d.
76. Of \$47.62 for 1 y. 6 mo. 15 d.
77. Of \$85.98 for 1 y. 9 mo. 17 d.
78. Of \$4287 for 2 y. 8 mo. 16 d.
79. Of \$5800 for 3 y. 11 mo. 13 d.
80. Of \$437.75 for 1 y. 10 mo. 29 d.
81. Of \$923.25 for 1 y. 3 mo. 26 d.
82. Of \$481.50 for 2 y. 1 mo. 19 d.

Interest at Rates other than 6%.

232. Illustrative Example.—What is the interest of \$328 for 1 year 3 months and 28 days, at 7% per annum? at 5%?

WRITTEN WORK.

Principal, \$328

Rate at 6%, 0.0792

3)656

2182

2952

2296

Interest at 6%, \$26.1302

(1) 4.3551

Interest at 7%, \$30.4857

Interest at 5%, \$21.7751

The interest is first computed at 6% because this is the most convenient rate.

This interest, increased by $\frac{1}{3}$ of itself, is the interest at 7%, and diminished by $\frac{1}{3}$ of itself, is the interest at 5%.

Ans. \$30.49; \$21.78.

233. Examples for Written Work.

83. What is the interest on \$920.75 for 2 years 6 months 24 days at 7%?

NOTE.—The phrase “at 7%” is abbreviated from “at 7% a year.” Such abbreviation is quite usual.

84. What is the interest on \$529.50 for 1 year 5 months 15 days at 5%?

85. What is the interest on \$928.50 for 4 years 3 months at 4%?

86. What is the interest on \$585.75 for 2 years 7 months at 8%?

87. What is the interest on \$349.60 for 9 months 16 days at $7\frac{1}{2}\%$?

88. What is the interest on \$556.20 for 11 months 26 days at $4\frac{1}{2}\%$?

89. What is the amount of \$750 for 1 year 8 months at $5\frac{1}{2}\%$?

90. What is the amount of \$1200 for 4 months 3 days at $6\frac{1}{2}\%$?

91. What is the amount of \$1900 for 3 years 8 months 12 days at $2\frac{1}{2}\%$?

92. What is the amount of \$581.50 for 2 years 3 months 21 days at $8\frac{1}{2}\%$?

93. Find 1 day's interest on \$6000 at 5%.

94. Find 1 day's interest on \$20,000 at 4%.

95. Find 3 days' interest on \$3000 at 3%.

96. Find 5 days' interest on \$50,000 at 5%.

97. Find 9 days' interest on \$9000 at 9%.

98. Find the interest on \$400 for 63 days at 5%.

99. Find the interest on \$375 for 93 days at 7%.

100. Find the interest on \$2000 for 33 days at $4\frac{1}{2}\%$.

101. What is the interest on \$3000 for 57 days at 4%?

102. What is the interest on \$10,000 for 2 days at 10%?

103. What is the interest on \$9000 for 19 days at 8%?

234. Interest from Date to Date.

Illustrative Examples. — (1) What is the time in years, months, and days, from January 11, 1895, to May 23, 1898?

SOLUTION :

From Jan. 11, 1895, to Jan. 11, 1898 3 y.
 From Jan. 11, 1898, to May 11, 1898 4 mo.
 From May 11 to May 23 12 d.

(2) What is the time in years, months, and days, from June 10, 1894, to March 3, 1896?

SOLUTION :

From June 10, 1894, to June 10, 1895 1 y.
 From June 10, 1895, to Feb. 10, 1896 8 mo.
 From Feb. 10 to March 3 (leap year) 22 d.

(3) What is the time in years, months, and days, from October 31, 1894, to March 15, 1897?

SOLUTION :

From Oct. 31, 1894, to Oct. 31, 1896 2 y.
 From Oct. 31, 1896, to Feb. 28, 1897 4 mo.
 From Feb. 28 to March 15 15 d.

235. These examples illustrate the usual

Rule.

To find the time from date to date : *Count first the entire years between the two dates, then the entire calendar months, and lastly the remaining days.*

236. Examples for Written Work.

Find the time in years, months, and days,

104. From January 19, 1894, to May 27, 1896.

105. From September 21, 1891, to December 31, 1897.

106. From February 8, 1894, to April 19, 1896.

Find the time in years, months, and days,

- 107. From March 29, 1894, to March 10, 1895.
- 108. From June 23, 1893, to July 5, 1897.
- 109. From August 31, 1894, to November 30, 1896.
- 110. From October 30, 1895, to March 15, 1896.
- 111. From May 31, 1894, to March 10, 1895.
- 112. From December 31, 1895, to January 1, 1897.

237. Miscellaneous Examples in Interest.

- 113. What is the interest at 6% on \$340 from November 21, 1894, to April 27, 1897?
- 114. What is the interest at 5% on \$7500 from January 10 to June 16 of the same year?
- 115. What is the amount of \$900 on interest from October 1, 1895, to November 30, 1897, at 6%?
- 116. What is the interest on \$526.60 from June 30, 1895, to March 19, 1897, at 8%?
- 117. What is the amount of \$7200 on interest at 7% from May 1, 1895, to February 29, 1896?
- 118. On the 12th of June, 1894, a merchant borrowed \$8000 at 5%, and repaid the loan with interest on the 27th of December, 1894. How much did he pay?
- 119. Find the amount due on a debt of \$628, which has been drawing interest at 6% from April 25, 1893, to the present time, July 6, 1895.
- 120. At the age of 20 years two young men received \$500 each. One put his money on interest at 5%, the other bought a library of books. At the age of 40 years, how much money had the first? How much should the second reckon to be the cost of his library?
- 121. What is the amount of \$1000 on interest for 50 years at 6%?

122. Compute the interest on the following note, which was paid January 15, 1895:

\$500.

NEW YORK, May 5, 1893.

For value received, I promise to pay John Denman, or order, Five Hundred Dollars on demand, with interest at 7%.

WILLIAM TYLER.

123. A note for \$3500, dated December 10, 1894, was paid November 4, 1896, with interest at $7\frac{1}{2}\%$. What amount was paid?

124. Find how much is due August 13, 1896, on a note given for \$725, and dated July 28, 1894, with interest at 7%.

125. On the 9th of March, 1894, a note for \$750 was given with interest at $5\frac{1}{2}\%$. What amount will be required to pay this note January 15, 1896?

126.

\$450.

BOSTON, October 10, 1894.

For value received, I promise to pay Thomas Hunter, or order, Four Hundred and Fifty Dollars, with interest at 6%.

SAMUEL WISEMAN.

On the 25th of April, 1895, Wiseman paid \$250 on this note. This payment covered the interest then due and a part of the principal. How much of the principal remained unpaid? This unpaid balance now drew interest until December 31, 1896, when the amount due was paid. How much was this payment?

NOTE.—This example illustrates *Partial Payments*.

127. A man borrowed \$250, agreeing to pay each year 6% interest. He did not pay the interest the first year, and so it was added to the principal, and the amount was taken as the principal for the second year.

At the end of the second year likewise, the interest being unpaid, it was added to the principal, and the amount formed the principal for the third year; and so on. How much did the man owe at the end of the fourth year?

NOTE. — Interest accumulated in this way is *Compound Interest*.

128. Find the amount of \$500 at compound interest for 3 years at 7%.


129. Find the amount of \$1000 at compound interest for 5 years at 5%.

130. Find the amount of \$400 at compound interest for 4 years at 6%.

Bank Discount.

238. On the 10th of June, 1895, Mr. John K. Pierson bought a carriage of Mr. William French, and agreed to pay \$350 for it in 60 days, giving Mr. French a written promise, in the following form, called

A Promissory Note.

	\$350.	Merrimae, Mass., June 10, 1895.
	Sixty days from date I promise to pay to	
	the order of-----William French-----	
	Four Hundred Fifty-----	Dollars
	at the Globe National Bank, Boston.	
	Value received.	
Due August 9/12.		John K. Pierson.

If Mr. French wants this money before the 60 days have run out, he can take the note to a bank and, by allowing the bank to

take out the interest on the sum named in the note for the time the note has to run and three days more, can get the rest of the money. On giving the note to the bank Mr. French writes his name across the back of the note (indorses it), and so becomes responsible for the payment of the note when due if Mr. Pierson should fail to pay it. The note is then said to be **discounted**.

239. The interest taken by a bank for advancing money on a note is called **bank discount**. The money received from the bank is the sum named in the note, called the **face of the note**, less the discount; and is called the **proceeds** or **cash value** of the note.

240. The three days for which interest is taken beyond the time named in the note are called **days of grace**. The maker of the note is allowed this extra time in which to pay it.

NOTE. — In some states days of grace are not permitted by law, and interest cannot be taken for them.

241. Find the discount and the proceeds on the above note supposing that Mr. French offered it for discount on the 18th day of June, the rate of discount being 6% per annum.

WRITTEN WORK.

Face of note, \$350

	55
	<hr/>
	1750
	175
	<hr/>
	6)19250
Discount,	3.208

\$350

3.21

Proceeds, \$346.79

The time the note has to run, from June 18 to August 12, is 55 days, and the interest on the face of the note for 55 days is \$3.21. The bank keeps this, and pays Mr. French \$346.79.

Ans. Discount, \$3.21; proceeds, \$346.79.

242. Examples for Written Work.

Find the bank discount and the proceeds of the following notes, discounted at date at 6%, three days of grace being allowed :

- 131. A 30 days' note for \$250.
- 132. A 60 days' note for \$800.
- 133. A 90 days' note for \$500.
- 134. A two months' note for \$750.
- 135. A four months' note for \$600.
- 136. A six months' note for \$1000.
- 137. A three months' note for \$950.
- 138. A five months' note for \$1200.
- 139. A one month's note for \$500.

Find the bank discount and the proceeds of the following notes :

140.

\$690.

BOSTON, February 24, 1895.

Sixty days after date, I promise to pay to the order of Thomas Watson, Six Hundred Ninety Dollars, at the Merchants' National Bank, value received.

DAVID HENSHAW.

Discounted, at date, at 6%.

141.

\$1500.

NEW YORK, May 6, 1895.

Thirty days after date, I promise to pay to the order of Alfred Sinclair, One Thousand Five Hundred Dollars, at the Second National Bank, value received.

MICHAEL DOWNER.

Discounted May 16, 1895, at 7%. No grace.

142.

\$825.

PHILADELPHIA, July 16, 1895.

Four months after date, I promise to pay to the order of Peter Grew, Eight Hundred Twenty-five Dollars, at the Third National Bank, value received.

WILLIAM HENDERSON.

Discounted, at date, at $7\frac{1}{2}\%$.

143.

\$1800.

ALBANY, N.Y., December 27, 1894.

Two months after date, we promise to pay to the order of the First National Bank, Eighteen Hundred Dollars, value received.

BENJAMIN POWERS' SONS.

Discounted January 12, 1895, at 7%. No grace.

144.

\$524 $\frac{85}{100}$.

CHICAGO, November 12, 1894.

Ninety days after date, we promise to pay to the order of Brown, Field & Remsen, Five Hundred Twenty-four and $\frac{85}{100}$ Dollars, value received.

ROGERS, MANNING & Co.

Discounted November 15, 1894, at 8%.

145.

\$1400.

MONTPELIER, VT., August 20, 1894.

Ninety days after date, I promise to pay to the order of James Edmands & Co., One Thousand Four Hundred Dollars, at the Vermont Bank, value received.

HENRY OTIS.

Discounted, at date, at 6%. No grace.

PART VIII.

MENSURATION.

Rectangles.

243. These two figures are alike in having four square corners, so each is called a rectangle; but they differ in



Square.



Oblong.

form, the square being as long as it is wide, while the oblong is longer than it is wide.

244. A square each of whose sides measures 1 inch is a **square inch**. A square each of whose sides measures 1 foot is a **square foot**. What is a square yard? A square rod? A square mile?

245. The **area** of any surface is the number of square units (square inches, square feet, etc.) required to cover the surface.

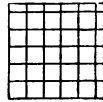
246. The area of a rectangle is found by *multiplying the number of units in the length by the number of like units in the width*. For shortness this is called *multiplying the length by the width*. (See lesson 29, page 35.)

247. Exercises.

1. How many square inches are there in the top of a desk 28 inches long and 20 inches wide?
2. Draw a square 12 inches (1 foot) long and 12 inches (1 foot) wide, and divide it into square inches. How many square inches make a square foot?

3. Draw a figure to show how many square feet make a square yard.

4. Draw a figure to show how many square yards make a square rod. How many whole square yards do you find? How many halves of a square yard? How many quarters? How many square yards altogether?



5. A square rod is $16\frac{1}{2}$ feet long and $16\frac{1}{2}$ feet wide. How many square feet does it contain? Draw a figure to show this.

6. A rectangular piece of land 16 rods long and 10 rods wide contains 1 acre. How many square rods are there in an acre?

7. A mile contains 320 rods. How many square rods does a square mile contain? How many acres of 160 square rods each?

8. Write the table of Square Measure, and repeat it orally. (See p. 228.)

9. A surveyor's chain is 4 rods long. How many square rods are there in a square chain? How many square chains make an acre?

10. How many square inches are there in the surface of a pane of glass measuring 10×14 inches?

NOTE.— This means 10 inches wide and 14 inches long. The sign \times is read "by." Dimensions are often given in this way.

11. How many square yards are there in the floor of a room measuring 28×32 feet?

12. Find the cost of paving a street $\frac{3}{4}$ of a mile long and 50 feet wide at \$4.50 per square yard.

13. Find the cost of covering a walk with asphalt at \$1.25 per square yard, the walk being 5 feet wide and 180 feet long.

14. How many square yards of plastering are there on the four walls and the ceiling of a room 18 feet long, 15 feet wide, and $10\frac{1}{2}$ feet high?

15. A garden 8 rods long and 12 rods wide contains how many square feet?

16. How many square feet are there in an acre of land? in $\frac{3}{8}$ of an acre?

17. What fraction of an acre is there in a rectangular house lot 150 feet wide and 250 feet long?

18. Draw a figure which shall show that $2\frac{1}{2} \times 2\frac{1}{2} = 6\frac{1}{4}$.

19. How many square feet and square inches are there in the top of a table $4\frac{1}{4}$ feet long and $3\frac{1}{8}$ feet wide?

20. How many square inches are there in each face of a common brick, which is 8 inches long, 4 inches wide, and 2 inches thick? How many square inches in all the faces together?

21. How many bricks laid flatwise will it take to pave a sidewalk 10 feet wide and 150 feet long? How much will the bricks cost at \$10.50 per thousand?

22. How many square feet of area will be covered by 1000 common bricks set on edge?

23. How many square yards of carpet will cover the floor of a room measuring 15×18 feet?

24. How many square feet are there in a board 15 feet long and 16 inches wide?

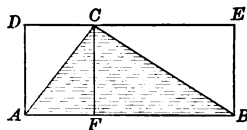
25. A field 18 rods long and 16 rods wide contains how many square rods? How many acres?

26. One field is 16 rods long and 10 rods wide; another is 20 rods long and 8 rods wide; and another is 32 rods long and 5 rods wide? How many square rods are there in each field? How many rods of fence are required to surround each field?

Triangles.

248. A plane figure bounded by three straight lines is a triangle.

Draw any triangle you please, as ABC . Then on the base, AB , draw a rectangle, making AD , the width of the rectangle, equal to FC , the height of the triangle. Now this rectangle has double the area of the triangle. For the shaded part ACF is equal to the unshaded part ACD , and the shaded part BCF is equal to the unshaded part BCE . So one half the whole rectangle is shaded, and this part is the triangle. Suppose AB is 8 feet and FC is 5 feet, how many square feet are there in the rectangle? How many square feet are there in the triangle?



NOTE.—The pupils should have triangular pieces of board, which they can measure and find the areas of. The height of a triangle is best measured with a square. Place one side of the square on the line of the base, so that the other side passes through the top. The distance of the top from the corner of the square is the height of the triangle.

249. To find the area of a triangle: *Multiply the base by-the height and divide the product by 2.*

250. Exercises.

27. What is the area of a triangle the base of which measures 14 inches, and the height 13 inches?

28. How many square feet are there in the surface of a triangle the height of which is 7 feet and the base 9 feet?

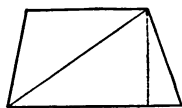
29. Cut from paper three triangles of different shapes but all having the same length of base and the same height. Have all three triangles the same area? Why?

30. A right-angled triangle has one square corner. Find the area of such a triangle, if the sides meeting at the square corner measure 10 inches and 6 inches.

31. The two sides forming the square corner of a right-angled triangle measure 18 feet and 24 feet. What is the area of the triangle?

32. How many square feet of boards are required to cover one end of a house which is 30 feet wide, and which has a pitched roof, the eaves being 28 feet above the sill, and the ridgepole 18 feet higher?

33. Draw a figure of four sides, two of them being parallel lines and two not parallel. Such a figure is called a **trapezoid**. Draw a line across it so as to divide it into two triangles.



Taking the two parallel sides of the trapezoid for the bases of the two triangles, the triangles have the same height, which is the width of the trapezoid. By finding the areas of both triangles and adding them, the area of the trapezoid is found. But a shorter way is to multiply half the sum of the two bases by the height.

Hence, to find the area of a trapezoid: *Multiply half the sum of the parallel sides by the distance between them.*

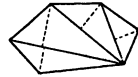
34. A trapezoid is 8 inches wide, and the parallel sides measure 16 and 20 inches. Draw such a figure and find its area.

35. A board which is wider at one end than it is at the other is a trapezoid, the two parallel sides being the two ends of the board, and the width of the trapezoid the length of the board. Find the number of square feet in a board 15 feet long, 20 inches wide at one end, and 14 inches wide at the other.

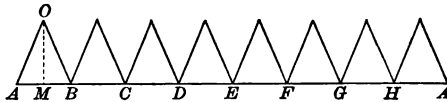
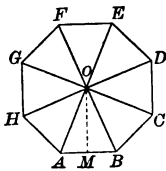
36. The average width of a board is its width measured halfway between the two ends. This is equal to half the sum of the widths at the ends. If a board is 19 inches wide at one end and 16 inches wide at the middle, how wide is it at the other end? How many square feet in this board, if it is 16 feet long?

Polygons.

251. Any plane figure bounded by straight lines is a **polygon**. The area of any polygon can be found by dividing it into triangles, finding the area of each triangle, and adding together these areas.



Draw a polygon with five sides and divide it into four triangles as in the figure; measure the base and the height of each triangle; compute the areas, and find the area of the polygon. Let one or more of your classmates do the same, and see how nearly your results agree. Absolute agreement cannot be expected, because absolute accuracy in measurement is not attainable. But the more accurate your measurements, the more nearly will your results agree.



252. A regular polygon can be divided into as many equal triangles as it has sides by drawing straight lines from the center to the corners.

The area of one of these triangles is half the product of the base AB by the height OM . The area of all the triangles is one half the product of the sum of all the bases multiplied by the

height of one of them. The polygon can be unfolded so that all the bases shall be in one straight line, as shown in the figure. It will be seen that all the triangles have the same height.

253. The bases of all the triangles taken together, or the distance around the polygon, is called the **perimeter** of the polygon. The height of one of the triangles, or the distance from the center to a side of the polygon, is called the **apothem**.

254. To find the area of a regular polygon: *Multiply the perimeter by the apothem and divide the product by 2.*

255. Exercises.

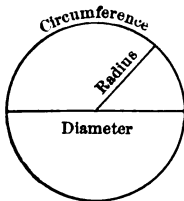
37. Find the area of the polygon above represented, supposing the side AB to measure 10 inches, and the apothem OM to measure 12.07 inches.

38. Find the area of a regular pentagon, one side of which measures 6 inches, and the apothem 4.13 inches.

39. Find the area of a regular hexagon, one side of which measures 10 inches, and the apothem 8.66 inches.

Circles.

256. A plane figure bounded by a curved line, every point of which is equally distant from a point within, called the center, is a **circle**.



257. The distance around a circle (the perimeter) is called the **circumference**. The distance from the center to any point of the circumference is the **radius**. The distance across a circle through the center is the **diameter**.

The diameter is double the radius.

Having a circular piece of board, measure with a tape measure the circumference. Measure the diameter. Divide the circumference by the diameter, and see how near the quotient comes to 3.14...

258. The exact value of the quotient of the circumference divided by the diameter cannot be expressed in numbers; expressed to four places of decimals it is 3.1416, but for all ordinary purposes it may be taken as $3\frac{1}{7}$ or $2\frac{2}{7}$. Hence,

To find the circumference of a circle when the diameter is given: *Multiply the diameter by $2\frac{2}{7}$.*

To find the diameter of a circle when the circumference is given: *Divide the circumference by $2\frac{2}{7}$.*

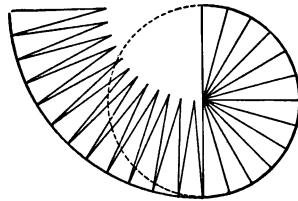
259. Examples for Written Work.

40. Find the circumference of a circle the diameter of which is 15 inches.

41. Find the circumference of a circle the radius of which is 4 feet.

42. Find the diameter of a circle the circumference of which is 30 feet.

260. A circle may be said to consist of a great many small triangles whose bases taken together form the circumference, the height of each triangle being equal to the radius. Hence,



To find the area of a circle: *Multiply the circumference by the radius and divide the product by 2.*

261. Examples for Written Work.

43. Find the area of a circle 2 ft. 4 in. in diameter.
44. Find the area of a circle the radius of which is 5 ft. 3 in.
45. How many square yards are there in a circular flower bed 20 feet in diameter?

262. Miscellaneous Examples.

46. If it takes a string 36 ft. 2 in. long to reach around the trunk of a large tree, what is the diameter?
47. How many times will a carriage wheel which is 4 feet in diameter turn in going one mile?
48. How wide a piece of sheet iron does it take to make a stove pipe 5 inches in diameter, allowing $1\frac{1}{2}$ inches for lapping at the joint?
49. What is the width of the widest board that can be sawed from a log measuring 7 ft. 4 in. in girth?
50. If a triangle has three equal sides, the height is 0.866 of one side. What is the height of a triangle each side of which is 5 inches? What is its area?
51. What is the area of an equal-sided triangle each side of which measures 45 feet?
52. By drawing lines from the center to the corners of a regular hexagon, the hexagon is divided into six equal-sided triangles. Find the area of a regular hexagon one side of which measures 6 inches.
53. Draw a square of any size you please (say 8 inches), and within it a circle, so that the circumference touches the four sides of the square. Find the area of the circle and that of the square, and find what part the former is of the latter. The result will always be

the same, whatever the size of the square you draw. What is the result in this case?

54. A square and a circle being drawn, as in the last example, join the four points, where the circumference touches the sides, so as to form a square within the circle. Show that the area of the inner square is one half that of the outer square. What is the area of a square drawn within a circle if the diameter of the circle is 14 inches?

55. Draw two squares each side of one being double a side of the other. How do their areas compare?

56. Draw two squares, each side of one being three times a side of the other. How do their areas compare?

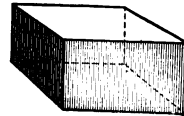
57. Find the area of a circle the diameter of which is 10 inches. Find the area of a circle the diameter of which is 20 inches. Divide the latter area by the former. What is the quotient? Take any two circles you please, the diameter of one being double that of the other, find their areas, and compare them in the same way. Is the result the same?

Thus learn that *if the diameter of one circle is double that of another, its area is four times that of the other.*

58. Find the areas of two circles, the diameter of one being three times that of the other. Compare these areas to find how many times one contains the other. What do you learn?

Rectangular Solids.

263. A **rectangular solid** is a solid bounded by six rectangles. A brick is a rectangular solid body. Mention other examples.



A Rectangular Solid.



A cube.

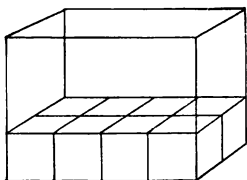
264. A **cube** is a rectangular solid bounded by six equal squares. A cube, each of whose faces is a square inch, is a cubic inch. A cube, each of whose faces is a square foot, is a cubic foot; etc.

265. The **volume**, or **solid contents**, of any solid is the number of cubic units (cubic inches, cubic feet, etc.) required to fill the solid.

266. To find the volume of a rectangular solid.

Illustrative Example. — What is the volume of a block of marble 4 feet long, 2 feet wide, and 3 feet thick?

ILLUSTRATION.



If the block is 4 feet long and 2 feet wide, its lower base contains 4×2 , or 8 square feet. A solid 1 foot thick upon these 8 square feet contains 8 cubic feet, and a solid 3 feet thick contains 3 times 8 or 24 cubic feet.

In the same way it can be shown that the volume of any rectangular solid is found by *multiplying the number of units in the length by the number of like units in the width, and this product by the number of like units in the thickness*. For shortness this is called *multiplying together the length, width, and thickness*.

267. Examples for Written Work.

59. How many cubic inches are there in a cube 12 inches (1 foot) long, 12 inches (1 foot) wide, and 12 inches (1 foot) high? Then how many cubic inches fill a cubic foot?

60. How many cubic feet are there in a cube measuring 3 feet (1 yard) each way? Then how many cubic feet are there in a cubic yard?

61. Write out the table of cubic measure. (Page 228.)

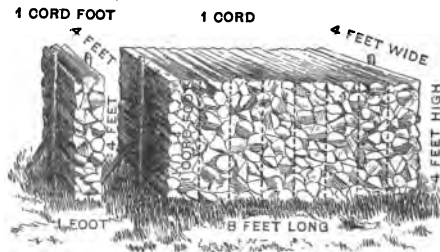
62. How many cubic inches will a box contain that is 11 inches long, 7 inches wide, and 6 inches high, inside measure?

63. How many cubic inches are there in a beam 5 feet long, 3 inches thick, and 4 inches wide?

64. A cubic foot of water weighs $62\frac{1}{2}$ pounds. What is the weight of water that a cistern may contain which measures on the inside 4 feet in length, 3 feet in width, and 4 feet in depth?

Wood.

268. Wood is generally cut for the market into sticks 4 feet long, and laid in piles, so that the length of the sticks becomes the width of the pile. A pile 4 feet wide, 4 feet high, and 8 feet long, contains 1 cord. How many cubic feet are there in 1 cord?



One eighth of a cord is called a **cord foot**. 1 cord foot contains 16 cubic feet.

65. How many cords of wood are there in a pile 20 feet long, 4 feet wide, and 4 feet high?

66. How many cords is a load of wood 3 feet 8 inches wide, 6 feet high, and 8 feet long?

Lumber and Boards.

269. The unit of measure for boards, plank, joist, and timber is a square foot one inch in thickness called a **board foot**.

NOTE. — Unless otherwise specified, all square lumber is reckoned as at least 1 in. thick; all over 1 in. to $1\frac{1}{4}$ in. as $1\frac{1}{4}$ in.; all over $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. as $1\frac{1}{2}$ in.; all over $1\frac{1}{2}$ in. to 2 in. as 2 in.; all over 2 in., according to thickness. Thus, a plank 20 ft. long, 9 in. wide, and $2\frac{1}{2}$ in. thick contains $20 \times \frac{9}{12} \times \frac{5}{2} = 37\frac{1}{2}$ board feet.

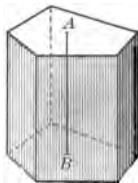
67. How many feet of boards, 1 inch thick, has a tight board fence, 2 rods long and 4 feet high?

68. How many feet board measure are there in a plank 7 feet long, $2\frac{1}{2}$ inches thick, 14 inches wide at one end and 10 inches wide at the other?

69. How many feet, board measure, are there in a pile of 12 boards, each board being $\frac{3}{4}$ of an inch thick, 14 feet long, 14 inches wide at one end and 11 inches wide at the other?

Prisms.

270. A solid bounded by two equal and parallel polygons (lower and upper base) and three or more rectangles is a **right prism**.



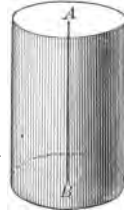
A Right Prism.

Suppose the area of the base of the prism here represented is 15 square inches, how many cubic inches could stand upon the base, making the prism 1 inch high? How many cubic inches would the prism contain if its height were 2 inches? 3 inches? 6 inches?

70. Find the volume of a right prism the base of which contains 25.7 square inches, and the height of which is 8.3 inches.

Cylinders.

271. A solid bounded by two equal and parallel circles and a curved surface, like that of a roller, connecting their circumferences is a **right cylinder**. In a right cylinder the line connecting the centers of the two bases, called the **axis**, is perpendicular to the bases.



A Right Cylinder.

272. The volume of a right cylinder is found in the same way as is that of a right prism. Hence,

To find the volume of a right prism or of a right cylinder : *Multiply the area of the base by the height.*

Pyramids.

273. A solid bounded by one polygon (the base) and three or more triangles meeting in one point at the top is a **pyramid**. The height of the pyramid is the perpendicular distance from the top to the base.

The figure represents a *right* pyramid, because the perpendicular AB from the top strikes the center of the base.



A Pyramid.

274. The volume of a pyramid is one third that of a prism having the same base and the same height.

Make a pyramid out of pasteboard, leaving off the base. Make a prism having bases of the same form and size as that of the pyramid and having the same height. Leave the prism open at one end. Now fill the pyramid with sand and pour it into the prism, and see if this cannot be done just three times.

Cones.

275. A solid bounded by one circle (the base) and a curved surface that comes to a point at the top, is a **cone**. In a true cone, this curved surface is such that a straight line drawn from the top to any point in the circumference of the base touches the surface all the way down. Hence when a cone is rolled on a plane surface, it touches the plane surface all the way from top to base.



A Cone.

Make a cone out of pasteboard, leaving off the base. Make a cylinder having the same base and the same height as the cone. Leave the cylinder open at one end. Now fill the cone with sand and pour it into the cylinder, and see if this cannot be done just three times.

276. The volume of a cone is one third that of a cylinder having the same base and the same height. Hence,

To find the volume of a pyramid or of a cone :
Multiply the area of the base by the height, and divide the product by 3.

277. Examples for Written Work.

71. The base of a right prism is a right-angled triangle, the two sides of which, meeting at the right angle, measure 6 inches and 8 inches respectively. The prism is 12 inches high. Find the volume.

72. The base of a right prism is an equal-sided triangle, and its height is equal to a side of the base. If this is 15 inches, what is the volume of the prism ? (See p. 218, Ex. 50.)

73. The base of a right prism being a regular pentagon each side of which measures 6 inches, and the height being 20 inches, find the volume. (See p. 216, Ex. 38.)

74. The base of a right prism being a regular hexagon each side of which measures 6 inches, and the height being 16 inches, find the volume. (See p. 218, Ex. 52.)

75. A pyramid having a square base measuring 14×14 inches is 2 ft. 3 in. high. How many cubic inches does it contain?

76. A house 40 feet square has a four-sided roof, all four sides coming to a point over the center of the house. If the eaves are 20 feet above the sills and the peak of the roof is 15 feet higher, how many cubic feet does the house occupy?

77. Find the number of cubic inches in a right cylinder the height of which is 20 inches and the diameter of the base 10 inches.

78. A cylindrical oil can 15 inches in diameter and 22 inches deep contains how many gallons?

NOTE. — A gallon contains 231 cubic inches.

79. Measure the diameter and the depth of a tin pail of cylindrical form and find how many quarts it holds. Suppose, for example, its depth is 8 inches and its diameter is 6 inches.

80. A cylindrical water tank built of iron is 20 feet in diameter and 50 feet high. How many gallons of water does it hold?

81. A tin dish is made in cylindrical form, a foot in diameter and a foot deep. What part of a cubic foot does it contain? How many gallons?

82. A bushel measure is described as a cylinder 18.5 inches in diameter and 8 inches deep. How many cubic inches does a bushel contain?

83. A tunnel used for pouring liquids into bottles is made in the form of a cone. Find how many gills are held by a tunnel 6 inches in diameter at the top and 8 inches deep.

Spheres.



A Sphere.

278. A solid bounded by one curved surface, every point of which is equally distant from a point within called the center, is a **sphere**.



A Hemisphere.

279. If a sphere is cut through by a plane, the cut surface is a circle. If the cutting plane passes through the center of the sphere, the cut surface is called a **great circle**, because this is the greatest circle that can be made by cutting the sphere by a plane. A great circle divides the sphere into two equal **hemispheres**.

280. The curved surface of a hemisphere has just double the area of the flat surface. Hence *the area of the whole surface of a sphere is equal to that of four great circles*.

281. A sphere may be regarded as made up of a great many small pyramids whose bases taken together make up the surface of the sphere, and whose tops all come together at the center of the sphere. Hence,

To find the volume of a sphere: *Multiply the surface by the radius, and divide the product by 3.*

282. Examples for Written Work.

84. A sphere 10 inches in diameter contains how many cubic inches?

85. A cubical box into which a sphere 10 inches in diameter will just go, contains how many cubic inches?

86. Find what part the volume of the sphere is of the volume of the box described in the last example.

Having any sphere and a cubical box, into which the sphere will just go, you may compare their volumes in this way. Fill the box just full of sand and weigh it. Pour out the sand and weigh the box. The difference is the weight of the sand that just fills the box. Put the sphere into the box and weigh them together. Fill all the space between the sphere and the sides of the box with sand, and weigh. From this last weight, subtracting the weight of sphere and box, you have the weight of sand that fills the space in the box outside the sphere. Comparing this with the weight of the sand filling the whole box, you find that the sphere fills $\frac{1}{8}$ of the box.

87. How many cubic feet of gas are required to fill a balloon of spherical form, if its diameter is 36 feet?

88. How many square feet of gold leaf are required to gild the dome of a building, if the dome is of hemispherical form 60 feet in diameter?

89. How many square inches are there in the surface of a football of spherical form 12 inches in diameter?

90. If cast iron weighs 450 pounds to the cubic foot, what is the weight of a spherical cannon ball 6 inches in diameter?

91. A dish is made in the form of a hemisphere 15 inches in diameter. How many pints of water will half fill it?

TABLES OF WEIGHTS AND MEASURES.

United States Money.

10 mills = 1 cent.
 10 cents = 1 dime.
 10 dimes = 1 dollar.
 10 dollars = 1 eagle.

Liquid Measure.

4 gills = 1 pint.
 2 pints = 1 quart.
 4 quarts = 1 gallon.

Dry Measure.

2 pints = 1 quart.
 8 quarts = 1 peck.
 4 pecks = 1 bushel.

Avoirdupois Weight.

16 ounces = 1 pound.
 2000 pounds = 1 ton.

Also sometimes used.

28 pounds = 1 quarter.
 4 quarters = 1 hundredweight.
 20 hundredweight = 1 ton (called long ton).

Troy Weight.

24 grains = 1 pennyweight.
 20 pennyweights = 1 ounce.
 12 ounces = 1 pound.

As used in mixing medicines.

20 grains = 1 scruple (♃).
 8 scruples = 1 dram (℥).
 8 drams = 1 ounce (℥).
 12 ounces = 1 pound.

Long Measure.

12 inches = 1 foot.
 3 feet = 1 yard.
 5½ yards or 16½ feet = 1 rod.
 320 rods or 5280 feet = 1 mile.

Square Measure.

144 square inches = 1 square foot.
 9 square feet = 1 square yard.
 80½ square yards or } = 1 square rod.
 272½ square feet }
 160 square rods = 1 acre.
 640 acres = 1 square mile.

Cubic Measure.

1728 cubic inches = 1 cubic foot.
 27 cubic feet = 1 cubic yard.
 128 cubic feet = 1 cord.

Time.

60 seconds = 1 minute.
 60 minutes = 1 hour.
 24 hours = 1 day.
 7 days = 1 week.
 365 days = 1 common year.
 366 days = 1 leap-year.
 100 years = 1 century.

Circular or Angular Measure.

60 seconds = 1 minute.
 60 minutes = 1 degree.
 360 degrees = 1 circumference.

Surveyors' Long Measure.

100 links = 1 chain (= 4 rods).
 80 chains = 1 mile.

Surveyors' Square Measure.

10000 square links = 1 square chain.
 10 square chains = 1 acre. [section.
 640 acres = 1 square mile or
 36 square miles or } = 1 township.
 sections }

Numbers.

12 units = 1 dozen.
 12 dozen = 1 gross.
 12 gross = 1 great gross.
 20 units = 1 score.

ANSWERS.

Ex. Ans.

Page 91.

1. 110.
2. 165.
3. 170.
4. 187.
5. 195.
6. 241.
7. 232.
8. 394.
9. 310.
10. 286.
11. 425.
12. 252.
13. 40.
14. 190.
15. 123.
16. 382.
17. 535.
18. 273.
19. 82.
20. 330.
21. 325.
22. 289.
23. 335.
24. 324.
25. 319.
26. 430.
27. 605.
28. 817.
29. 838.
30. 355.
31. 708.
32. 516.
33. 649.
34. 416.
35. 708.
36. 907.
37. 759.
38. 908.

Ex. Ans.

Page 92.

39. 390.
40. 383.
41. 367.
42. 445.
43. 439.
44. 420.
45. 920.
46. 1012.
47. 924.
48. 830.
49. 921.
50. 1021.
51. 1021.
52. 1033.
53. 1143.
54. 1153.
55. 1224.
56. 1306.
57. 230.
58. 90.
59. 323.
60. 95.
61. 120.
62. 89.
63. 331.
64. 89.
65. 243.
66. 178.
67. 367.
68. 65.
69. 139.
70. 89.
71. 348.
72. 89.
73. 249.
74. 97.
75. 188.
76. 12.

Ex. Ans.

77. 247.

78. 59.

79. 403.

80. 197.

81. 496.

82. 873.

83. 952.

84. 804.

85. 1495.

86. 767.

Page 93.

1. \$241.
2. 113¢.
3. \$24.53.
4. \$27.96.
5. \$21.78.
6. \$144.97.
7. \$196.83.
8. \$373.36.
9. \$216.66.
10. \$192.38.
11. \$203.63.
12. \$166.03.

Page 94.

13. \$33.85.
14. \$283.32.
15. \$68.03.
16. \$168.61.
17. \$287.38.
18. \$20.99.
19. \$22.85.
20. \$4.17.
21. \$16.35.
22. \$173.55.
23. \$112.70.

Ex. Ans.**Page 95.**

24. \$ 1.37.
 25. \$ 6.04.
 26. \$ 7.46.
 27. \$ 28.29.
 28. \$ 8.69.
 29. \$ 55.47.
 30. \$ 8.06.
 31. \$ 18.26.
 32. \$ 14.51.
 33. \$ 6.67.
 34. \$ 1.15.
 35. \$ 12.43.
 36. \$ 10.31.
 37. \$ 21.49.
 38. \$ 50.73.
 39. \$ 71.00.
 40. \$ 4.08.
 41. \$ 90.44.
 42. \$ 7.57.
 43. \$ 73.51.
 44. \$ 2380.
 45. \$ 1225.
 46. \$ 141.23.

Page 96.

1. 33.
 2. 116.
 3. 152.
 4. 135.
 5. 223.
 6. 294.
 7. 228.
 8. 192.
 9. 276.
 10. 145.
 11. 190.
 12. 235.
 13. 325.
 14. 162.
 15. 228.
 16. 294.
 17. 336.
 18. 182.
 19. 301.
 20. 665.
 21. 546.
 22. 232.
 23. 384.

Ex. Ans.

24. 504.
 25. 456.
 26. 261.
 27. 342.
 28. 423.
 29. 504.
 30. 174.
 31. 371.
 32. 616.

Page 97.

1. 216.
 2. 317.
 3. 428.
 4. 239.
 5. 228.
 6. 325.
 7. 142.
 8. 250.
 9. 273.
 10. 219.
 11. 316 yd.
 12. 191 bu.
 13. 223 passengers.

Page 102.

1. 184 persons.
 2. \$ 90.21.
 3. 156 times.
 4. 300 strokes.
 5. 276 passengers.
 6. 972 panes.
 7. 9870 caterpillars.
 8. 635 trees.
 9. Lost \$ 0.20.
 10. \$ 1.24.
 11. Gained \$ 1.68.

Page 103.

1. \$ 142 $\frac{1}{2}$.
 2. \$ 412 $\frac{1}{2}$.
 3. \$ 504 $\frac{1}{2}$.
 4. 687 $\frac{1}{2}$ acres.
 5. \$ 126 $\frac{1}{2}$.
 6. 2187 $\frac{1}{2}$.
 7. 1458 $\frac{1}{2}$.
 8. 1093 $\frac{1}{2}$.
 9. 376 $\frac{1}{10}$.

Ex. Ans.

10. 713 $\frac{1}{2}$.
 11. 803 $\frac{1}{2}$;
 648 $\frac{1}{2}$.
 12. 214 $\frac{1}{2}$;
 211 $\frac{1}{2}$.
 13. 137 $\frac{1}{2}$;
 876 $\frac{1}{10}$.
 14. 817 $\frac{1}{5}$;
 320 $\frac{1}{10}$.
 15. \$ 145 $\frac{1}{2}$.
 16. \$ 160 $\frac{1}{2}$.
 17. \$ 219 $\frac{1}{2}$.
 18. \$ 956.

Page 106.

1. \$ 139.
 2. \$ 65.50.
 3. 86 yr.
 4. 888 A.D.
 5. \$ 228.
 6. 839 pupils;
 167 $\frac{1}{2}$ pupils.
 7. 157 pupils.
 8. 364 qt;
 \$ 25.48;
 \$ 10.98.
 9. \$ 805;
 \$ 6448.
 10. 19 bbl.

Page 107.

11. 310 mi.
 12. 5989 ft.
 13. \$ 11.34.
 14. \$ 2.38.

Page 108.

18. \$ 28.45.
 19. \$ 1.80.
 20. 582 ft.
 21. 269 ft.
 22. \$ 29.
 23. 1461 days.
 24. 63¢.
 25. \$ 2.68 $\frac{1}{2}$.
 26. 296 shoes;
 74 horses.
 27. 32 times.

Ex. Ans.
Page 109.

28. \$28.27.
29. 8940 ft;
3660 ft.
30. 6748 sq. ft.
31. \$4.08.
32. 1776.

Page 111.

3. 26.;
26,000;
26,000,000.
4. 906;
906,000;
906,000,000.
6. 328,432,528.
7. 42,036,045.

Page 112.

29. 4456.
30. 26,557.
31. 17,021.
32. 54,706.
33. 20,870.
34. 70,065.
35. 610,080.
36. 203,708.
37. 390,810.
38. 1,130,909.
39. 30,700,000.
40. 16,050,402.

Page 114.

6. VIII;
XI;
XIV;
XXVI;
XXIX.
7. IX;
XVI;
XIX;
XXXV;
XXXVIII.
15. XLII;
LIII;
LXVII;
LXXV.
16. LXXXIV;
LXXXVIII;
XC;
XCVI.

Ex. Ans.
Page 115.

1. \$2645.08.

Page 116.

2. 3013 lb.
3. 14,975 lb.
4. 6,116,057.
5. 101,101,110.
6. 3,917,170.
7. 1,523,397.
8. 265,780 sq. mi.
9. \$7,494.85.
10. 85,063.
11. 119,097.
12. 110,218.
13. \$7,496.82.

Page 117.

14. \$587.30.
15. 52,000,000 sq. mi.
16. 2051.
17. 1978.
18. 4150.
19. 2400.
20. 1692.
21. 2836.
22. 2121.
23. 1466.
24. 2464.
25. 10,579.
26. \$92.90.
27. \$165.51.
28. \$249.23.
29. \$2044.39.
30. \$650.85.
31. \$154.19.
32. \$189.66.
33. \$124.89.
34. \$899.16.
35. \$533.28.
36. \$2552.03.

Page 118.

1. \$1225.
2. 170 years.

Page 119.

3. 462 years.
4. \$35.
5. \$264.

Ex. Ans.

6. \$378.
7. \$85.
8. 12,047.
9. 3958 ft.
10. 283 years.
11. 2003.
12. 234 mi.
13. 22,917 A.

Page 120.

14. \$1730.
15. \$1275.
16. \$999.
17. 128,314 males;
218,978 females;
347,292 both.
18. 87,388;
3,276;
90,664.
19. 2,630,021.
20. 62,765.
21. \$2267.03.
22. \$1675.52.
23. \$1066.13.
24. \$474.62.
25. \$96.92.
26. \$75.87.
27. \$1264.88.
28. \$1243.83.

Page 121.

1. 250.
2. 500.
3. 840.
4. 1440.
5. 7300.
6. 25,000.
7. 114,300.
8. 67,560.
9. 675,000.
10. 445,500.
11. 495,000.
12. 5,136,000.

Page 122.

13. 2000.
14. 6000.
15. 7200.
16. 304,000.
17. 240,000.

Ex.	Ans.
18.	80,000.
19.	1000; 3000.
20.	360 mo.; 3600 mo.
21.	480 in.; 4800 in.
22.	60 min.; 1440 min.
23.	3600 sec.
24.	\$ 100.
25.	\$ 80.
26.	\$ 34,000.
27.	736.
28.	168; 2100; 2268.
29.	168; 1120; 1288.
30.	305; 3050; 3355.
31.	432; 3600; 4032.
32.	148; 2590; 2738.
33.	108; 1440; 1548.
34.	665; 7600; 8265.
35.	432; 2880; 3312.

Page 123.

36.	1610.
37.	1610.
38.	2688.
39.	1924.
40.	3072.
41.	975.
42.	4408.
43.	7387.
44.	5293.
45.	2412.
46.	4489.
47.	1844.
48.	2340.
49.	1700.
50.	3536.
51.	1125.
52.	7426.
53.	3071.
54.	7802.
55.	2923.
56.	5293.
57.	8366.
58.	7426.
59.	5943.
60.	1400.
61.	5766.
62.	2325.
63.	3472.
64.	5796.
65.	1175.

Ex.	Ans.
66.	2961.
67.	2300.
68.	2610.
69.	4984.
70.	5162.
71.	2520.
72.	2352.
73.	4958.
74.	1608.
75.	7252.
76.	990 lb.
77.	\$ 168; \$ 252.

Page 124.

78.	6512.
79.	11,638.
80.	9120.
81.	6272.
82.	\$ 32,338.
83.	\$ 106,522.
84.	22,560.
85.	\$ 508.95.
86.	\$ 1419.12.
87.	12,438.
88.	\$ 2386.80.
89.	26,994.
90.	\$ 5332.26.
91.	\$ 255.
92.	23,040 acres.
93.	360 h.; 21,600 mi. 1,296,000 sec.;
94.	56,940 strokes.
95.	15,680 ft.
96.	86,832 sq. ft.
97.	—.

Page 125.

98.	\$ 84.24.
99.	1,678,400 sec.
100.	1064 lb.
101.	45,000 lb.
102.	\$ 162.50.
103.	\$ 206.25.
104.	\$ 70.
105.	\$ 6.85.
106.	\$ 26.52.
107.	\$ 10.01.
108.	\$ 408.

Ex.	Ans.
109.	\$ 1,950,000 people.
110.	835,800 yd.
111.	39,220 strands.

Page 127.

1.	217,538.
2.	92,181.
3.	189,500.
4.	67,308½.
5.	23,977½.
6.	123,614½.
7.	22,508½.
8.	822,678½.
9.	1,209,479½.
10.	951,906.
11.	218,292½.
12.	1,294,721½.
13.	503,858½.
14.	207,015½.

Page 128.

15.	35.
16.	23.
17.	25.
18.	26.
19.	36.
20.	22.
21.	34.
22.	26.
23.	31.
24.	32.
25.	28.
26.	52.

Page 129.

27.	121½.
28.	34½.
29.	50½.
30.	61½.
31.	48½.
32.	52½.
33.	95½.
34.	127½.
35.	1480½.
36.	2096½.
37.	346½.
38.	324½.

Ex. Ans.

39. 647 $\frac{1}{2}$.
 40. $398\frac{1}{2}$.
 41. $301\frac{1}{2}$.
 42. $1338\frac{1}{2}$.
 43. $520\frac{1}{2}$.
 44. $302\frac{1}{2}$.
 45. $1571\frac{1}{2}$.
 46. $950\frac{1}{2}$.
 47. $978\frac{1}{2}$.
 48. $2068\frac{1}{2}$.
 49. $2190\frac{1}{2}$.
 50. $1565\frac{1}{2}$.
 51. $729\frac{1}{2}$.
 52. $916\frac{1}{2}$.
 53. $1738\frac{1}{2}$.
 54. $3783\frac{1}{2}$.
 55. $690\frac{1}{2}$.
 56. $10,435\frac{1}{2}$.

Page 130.

65. \$58.64; \$348.75.
 66. 77; 8 rem.
 67. 1215; 20 rem.
 68. 1464; 18 rem.

Page 131.

69. 40 days.
 70. $45\frac{1}{2}$ mi.
 71. 352 times.
 72. $609\frac{1}{2}$ times.
 73. 48 rows.
 74. 81 hills.
 75. 20 bbl.; 80 rem.
 76. 14 bags; 112 rem.
 77. 16 bags.
 78. 9 payments;
 \$1100.
 79. 5 times.
 80. 68,400 mi.;
 1140 mi.

Page 132.

81. 120 books.
 82. 27 boxes; 14 rem.
 83. 37 yd.; 5 ϕ rem.;
 62 yd.; \$1.80 rem.

Ex. Ans.

84. 23 vines; 34 ϕ
 rem.
 85. 14 pairs; 50 ϕ
 rem.
 86. 5 hats; \$1.90
 rem.
 87. 62 meals; 10 ϕ
 rem.
 88. 200 acres.
 89. 77 bbl.; 14 ϕ rem.

Page 133.

90. \$1.25.
 91. 22 ϕ .
 92. \$18.50.
 93. \$5.67.
 94. \$11.50.
 95. 212 feet.
 96. 132 feet.
 97. 129 feet.
 98. 279 feet.

Page 134.

99. 32 feet.
 100. 1540 yr.
 101. \$1650.
 102. 4,340,000 heads.
 103. \$9.24.
 104. \$260.
 105. \$43.70;
 \$64.98;
 \$21.28.
 106. \$2245.

Page 135.

107. \$7200.
 108. \$100.
 109. \$672.
 110. 625 days.
 111. 224 tons.
 112. 3,906,593 sq. mi.
 113. $1059\frac{1}{2}$ lb.
 114. 14,000 min.
 115. 132,000 ft.; 25
 mi.
 116. 85 mi.

Ex.

Ans.

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1. —.
 2. —.
 3. —.
 4. $6=2\times 3$;
 $8=2\times 2\times 2$;
 $9=3\times 3$.
 5. $10=2\times 5$;
 $12=2\times 2\times 3$;
 $15=3\times 5$.
 6. $16=2\times 2\times 2\times 2$;
 $18=2\times 3\times 3$;
 $20=2\times 2\times 5$.
 7. $21=3\times 7$;
 $22=2\times 11$;
 $24=2\times 2\times 2\times 3$.
 8. $25=5\times 5$;
 $27=3\times 3\times 3$;
 $30=2\times 3\times 5$.
 9. $32=2\times 2\times 2\times 2\times 2$;
 $33=3\times 11$;
 $35=5\times 7$.
 10. $36=2\times 2\times 3\times 3$;
 $40=2\times 2\times 2\times 5$;
 $42=2\times 3\times 7$.
 Page 138.
 11. $45=3\times 3\times 5$;
 $48=2\times 2\times 2\times 2\times 3$;
 $49=7\times 7$.
 12. $50=2\times 5\times 5$;
 $54=2\times 3\times 3\times 3$;
 $55=5\times 11$.
 13. $56=2\times 2\times 2\times 7$;
 $60=2\times 2\times 3\times 5$;
 $63=3\times 3\times 7$.
 14. $66=2\times 3\times 11$;
 $70=2\times 5\times 7$;
 $72=2\times 2\times 2\times 3\times 3$.
 15. $80=2\times 2\times 2\times 2\times 5$;
 $81=3\times 3\times 3\times 3$;
 $84=2\times 2\times 3\times 7$.
 16. $90=2\times 3\times 3\times 5$;
 $96=2\times 2\times 2\times 2\times 3$;
 $100=2\times 2\times 5\times 5$.

Ex. Ans.

$$17. 108 = 2 \times 2 \times 3 \times 3 \times 3;$$

$$120 = 2 \times 2 \times 2 \times 3 \times 5;$$

$$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3.$$

18. 9.

19. 14.

20. 12.

21. 9.

22. 5.

23. 9.

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1. 24; 30; 36.

2. 10; 35; 40.

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4. 40.

5. 36.

6. 70.

7. 72.

8. 72.

9. 48.

1. 14.

2. 18.

3. 6.

4. 9.

5. 2.

6. 12.

7. 4.

8. 12.

9. $11\frac{1}{2}$.

10. 4.

11. 5.

12. $13\frac{1}{2}$.

13. 44.

14. 4.

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29. $11\frac{7}{8}$.

30. $7\frac{1}{7}$.

31. $20\frac{2}{15}$.

32. $21\frac{1}{4}$.

33. $22\frac{8}{11}$.

34. 21.

35. $23\frac{7}{21}$.

36. 25.

Ex. Ans.

37. $11\frac{1}{4}$.

38. $21\frac{1}{2}$.

39. $18\frac{1}{2}$.

40. 27.

41. $12\frac{3}{4}$.

42. $11\frac{1}{4}$.

43. 12.

44. $1\frac{1}{4}$; $1\frac{1}{3}$; $2\frac{1}{4}$; $5\frac{2}{5}$;

$9\frac{2}{3}$; $4\frac{1}{2}$; $1\frac{1}{2}$;

$1\frac{1}{2}$;

45. $2\frac{2}{3}$; $3\frac{2}{3}$; $5\frac{2}{3}$; $2\frac{2}{3}$;

$6\frac{2}{3}$; $6\frac{2}{3}$; $1\frac{2}{3}$;

$3\frac{2}{3}$;

46. $4\frac{1}{2}$; $4\frac{1}{2}$; $4\frac{1}{2}$; $7\frac{7}{8}$;

$2\frac{1}{2}$; $3\frac{1}{2}$; $1\frac{2}{3}$;

$1\frac{1}{2}$;

47. $1\frac{1}{2}$.

48. $1\frac{1}{2}$.

49. $1\frac{1}{2}$.

50. $3\frac{1}{2}$.

51. $4\frac{1}{2}$.

52. $4\frac{1}{2}$.

53. $3\frac{1}{2}$.

54. $8\frac{1}{2}$.

55. $8\frac{1}{2}$.

56. $7\frac{1}{2}$.

57. $1\frac{1}{2}$.

58. $3\frac{1}{2}$.

59. $1\frac{1}{2}$.

60. $10\frac{1}{2}$.

61. $2\frac{1}{2}$.

62. $2\frac{1}{2}$.

63. $2\frac{1}{2}$.

64. $4\frac{1}{2}$.

65. $13\frac{1}{2}$.

66. $9\frac{1}{2}$.

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67. $1\frac{1}{2}$.

68. $1\frac{1}{2}$.

69. $1\frac{1}{2}$.

70. 2.

71. $1\frac{1}{2}$.

72. $1\frac{1}{2}$.

Ex. Ans.

73. $\frac{1}{2}$.

74. $\frac{1}{2}$.

75. $1\frac{1}{2}$.

76. $14\frac{1}{2}$.

77. $17\frac{1}{2}$.

78. $29\frac{1}{10}$.

79. $15\frac{1}{2}$.

80. $20\frac{1}{2}$.

81. $3\frac{1}{2}$.

82. $6\frac{1}{2}$.

83. $6\frac{1}{2}$.

84. $7\frac{1}{2}$.

85. $11\frac{1}{2}$.

86. $5\frac{1}{2}$.

87. $7\frac{1}{2}$.

88. $6\frac{1}{2}$.

89. $9\frac{1}{2}$.

90. $11\frac{1}{2}$.

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91. $b\frac{1}{2}$; $c\frac{1}{2}$.

92. $\frac{1}{2}$.

93. $1\frac{1}{2}$.

94. $\frac{1}{2}$.

95. $\frac{1}{2}$.

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96. $1\frac{1}{2}$.

97. $\frac{1}{2}$.

98. $\frac{1}{2}$.

99. $1\frac{1}{2}$.

100. $\frac{1}{2}$.

101. $\frac{1}{2}$.

102. $1\frac{1}{2}$.

103. $1\frac{1}{2}$.

104. $7\frac{1}{2}$.

105. $18\frac{1}{2}$.

106. $1\frac{1}{2}$.

107. $7\frac{1}{2}$.

108. $27\frac{1}{2}$.

109. $27\frac{1}{2}$.

110. $27\frac{1}{2}$.

111. $65\frac{1}{2}$.

112. $38\frac{1}{2}$.

Ex.	Ans.
113.	$51\frac{1}{2}$.
114.	$34\frac{1}{2}$.
115.	$27\frac{1}{2}$.
116.	$4\frac{3}{4}$.
117.	$2\frac{1}{5}$.
118.	$3\frac{1}{2}$.
119.	$\frac{1}{2}$.
120.	$25\frac{3}{8}$.
121.	$13\frac{1}{2}$.
122.	$14\frac{3}{8}$.
123.	$3\frac{1}{2}$.
124.	$\frac{1}{5}$.
125.	$9\frac{3}{8}$.
126.	$44\frac{3}{4}$.
127.	$53\frac{1}{2}$.
128.	$26\frac{3}{8}$.
129.	$17\frac{3}{8}$.
130.	$24\frac{1}{2}$.
131.	$16\frac{1}{8}$.
132.	$29\frac{3}{8}$.
133.	$58\frac{3}{4}$.
134.	$31\frac{1}{2}$.
135.	$60\frac{3}{8}$.
136.	$2\frac{1}{4}$.
137.	$3\frac{5}{8}$.
138.	$4\frac{1}{4}$.
139.	$6\frac{3}{4}$.
140.	$5\frac{5}{8}$ lb.
141.	$\$4\frac{1}{2}$.
142.	$\frac{2}{3}$.
143.	$2\frac{7}{8}$ yd.; $1\frac{3}{8}$ yd.

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144.	$9\frac{9}{10}$.
145.	$6\frac{1}{2}$.
146.	A $\frac{1}{2}$; B $\frac{1}{4}$; both $\frac{1}{4}$.
147.	$1\frac{1}{2}$ ft.
148.	$7\frac{1}{2}$ yd.
149.	$13\frac{1}{2}$ qt.
150.	$3\frac{1}{4}$ acres.
151.	$42\frac{3}{4}$ lb.
152.	$43\frac{3}{4}$ rd.

Ex.	Ans.
153.	$118\frac{1}{8}$ lb.
154.	$\$4166\frac{2}{3}$.
155.	$36\frac{1}{10}$ mi.

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1.	$3\frac{1}{2}$.
2.	$3\frac{3}{4}$.
3.	4.
4.	$2\frac{1}{2}$.
5.	$2\frac{1}{2}$.
6.	$4\frac{9}{10}$.
7.	$4\frac{1}{2}$.
8.	$5\frac{1}{2}$.
9.	$2\frac{1}{2}$.
10.	$5\frac{1}{2}$.
11.	$5\frac{1}{2}$.
12.	$5\frac{1}{2}$.
13.	$2\frac{1}{2}$.
14.	$1\frac{3}{4}$.
15.	$3\frac{3}{4}$.
16.	$8\frac{1}{2}$.
17.	$\$1.12\frac{1}{2}$.
18.	$\$3\frac{3}{4}$.
19.	$\frac{3}{4}$ y.; $2\frac{1}{2}$ y.; $3\frac{3}{4}$ y.
20.	$\$2\frac{1}{10}$; $\$2\frac{7}{10}$.

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21.	$6\frac{1}{2}$ sq. ft.
22.	$\$33\frac{1}{2}$.
23.	$\$45$.
24.	$\$67\frac{1}{2}$.

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35.	$\frac{2}{3}$.
36.	$\frac{1}{10}$.
37.	$\frac{8}{15}$.
38.	$\frac{1}{4}$.
39.	$1\frac{1}{2}$.
40.	$\frac{1}{3}$.
41.	$\frac{7}{8}$.
42.	$\frac{1}{2}$.
43.	$2\frac{1}{4}$.
44.	$\frac{7}{8}$.
45.	$\frac{7}{8}$.

Ex.	Ans.
46.	$\frac{1}{12}$.
47.	32 qt.; $211\frac{1}{2}$ qt.
48.	$256\frac{1}{2}$ in.
49.	$67\frac{3}{4}$ days.
50.	$\$37\frac{3}{4}$; $\$67\frac{3}{4}$.
51.	3.
52.	$2\frac{5}{8}$.
53.	$\frac{2}{3}$.
54.	$38\frac{1}{2}$.
55.	49.
56.	63.
57.	$67\frac{1}{2}$.
58.	$45\frac{1}{2}$.
59.	68.
60.	$49\frac{1}{2}$.
61.	$36\frac{3}{8}$.
62.	$92\frac{1}{4}$.

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63.	$\frac{5}{12}$.
64.	$\frac{8}{17}$.
65.	$\frac{1}{3}$.
66.	$53\frac{1}{4}$ rd.
67.	$19\frac{1}{2}$ days.
68.	198 in.
69.	$17\frac{1}{2}$ lb.
70.	$\$34\frac{1}{2}$.
71.	$80\frac{1}{2}$ min.
72.	1000 oz.
73.	$4229\frac{1}{2}$ lb.
74.	$178\frac{1}{8}$ sq. ft.
75.	$284\frac{3}{8}$ sq. ft.
76.	$24\frac{1}{2}$ tons.
77.	$3\frac{1}{2}$ hours.

Page 155.

1.	$\frac{1}{2}$; $\frac{1}{3}$; $\frac{2}{3}$; $\frac{5}{6}$.
2.	$\frac{8}{9}$; $\frac{1}{4}$; $1\frac{5}{8}$; $2\frac{7}{8}$; $2\frac{5}{8}$.
3.	$\frac{1}{7}$; $\frac{1}{4}$; $\frac{2}{3}$; $\frac{5}{8}$; $1\frac{1}{10}$.
4.	$\frac{1}{2}$.
5.	$\frac{2}{3}$.
6.	$\frac{1}{4}$; $\frac{1}{2}$; $\frac{3}{4}$.

Ans.
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7. \$6 $\frac{1}{2}$.
8. 1 $\frac{1}{2}$ yd.
9. 2 $\frac{1}{2}$ ft.
10. $\frac{1}{2}$; $\frac{1}{3}$; $\frac{1}{4}$; $\frac{1}{5}$.
11. 3 $\frac{2}{3}$; 2 $\frac{1}{3}$; 2 $\frac{1}{3}$; 2 $\frac{1}{3}$; 1 $\frac{1}{2}$; 1 $\frac{1}{2}$.
12. \$ $\frac{3}{5}$.
13. $\frac{2}{3}$ days.
14. \$1 $\frac{1}{2}$.
15. 1 $\frac{3}{4}$ days;
1 $\frac{1}{4}$ days.
16. \$13 $\frac{1}{2}$; \$1 $\frac{1}{2}$.
17. 30 $\frac{1}{2}$ sq. ft.
18. $\frac{1}{4}$ 7. 21. $\frac{2}{3}$ 5.
19. $\frac{3}{5}$ 6. 22. $\frac{3}{4}$ 7.
20. $\frac{1}{2}$ 7. 23. $\frac{5}{8}$.

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27. 10.
28. 12.
29. 6 $\frac{3}{4}$; 6 $\frac{1}{4}$; 5 $\frac{1}{2}$; 13 $\frac{1}{2}$;
7 $\frac{1}{2}$.
30. 24; 20; 9; 6 $\frac{2}{5}$.

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31. 2; 4; 1 $\frac{1}{2}$; 5.
32. 4; 11; 3; 2.

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33. 1 $\frac{1}{2}$. 47. 7 $\frac{1}{10}$.
34. 1 $\frac{1}{2}$. 48. 8 $\frac{1}{2}$.
35. 1 $\frac{1}{16}$. 49. 3 $\frac{1}{4}$.
36. 1 $\frac{1}{5}$. 50. 6 $\frac{1}{5}$.
37. $\frac{3}{4}$. 51. $\frac{3}{4}$.
38. 1 $\frac{1}{2}$. 52. 33 $\frac{1}{2}$.
39. $\frac{3}{4}$. 53. 18 $\frac{3}{4}$.
40. $\frac{3}{5}$. 54. 10.
41. 1 $\frac{1}{2}$. 55. 28 $\frac{1}{2}$.
42. 1 $\frac{1}{2}$. 56. 2 $\frac{1}{2}$.
43. 1 $\frac{1}{2}$. 57. 10 $\frac{1}{10}$.
44. 1 $\frac{1}{10}$. 58. 1 $\frac{1}{2}$.
45. 3 $\frac{1}{2}$. 59. 7.
46. 18 $\frac{1}{2}$. 60. 38 $\frac{1}{2}$ bu.

- Ans.**
61. 6 steps.
62. \$11 $\frac{1}{2}$.
63. 14 loops.
64. 7 $\frac{1}{2}$ tons.
65. 9 $\frac{1}{2}$ d.
66. 14 gar.
67. 18 bbl.
68. 6 cu. ft.

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69. $\frac{1}{2}$. 77. $\frac{1}{2}$.
70. $\frac{2}{3}$. 78. $\frac{1}{2}$.
71. $\frac{1}{3}$. 79. $\frac{5}{8}$.
72. $\frac{1}{4}$. 80. $\frac{1}{5}$.
73. $\frac{3}{4}$. 81. 1 $\frac{1}{2}$.
74. $\frac{1}{2}$. 82. 8.
75. $\frac{1}{3}$. 83. 14.
76. $\frac{3}{4}$. 84. 12.

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12. $\frac{1}{2}$. 18. $\frac{3}{4}$.
13. $\frac{7}{8}$. 19. $\frac{1}{6}$.
14. $\frac{3}{4}$. 20. $\frac{1}{4}$.
15. $\frac{1}{2}$. 21. \$50; $\frac{1}{4}$.
16. $\frac{1}{2}$. 22. $\frac{1}{4}$.
17. $\frac{1}{2}$.

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24. \$4.
25. \$10.
26. \$1 $\frac{2}{3}$; \$2 $\frac{1}{3}$.
28. 6; 30; 48; 3.
29. 8; 16; 32; 64; 48.

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31. 20 ϕ .
32. 24 ϕ .
33. \$2.40.
34. \$8.
35. \$10; \$50.
36. \$1.20.
37. 14 h.
38. 424.
39. 55 lb.

- Ans.**
40. 32 cu. ft.
41. 18 oz.
42. 12 ϕ .

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43. 33 lb.
44. 40 boxes.
45. 27 pigs.
46. 60 lb.
47. 88 in.
48. 200 lb.
49. 25 ϕ .
50. 30 ϕ .
51. 20 ϕ .
52. 30 ϕ .
53. 32 ϕ .
54. 161 sheep.
55. \$400.
56. \$40.

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1. 9 $\frac{1}{2}$ hours.
2. $\frac{1}{10}$.
3. \$600.
4. $\frac{3}{5}$; $\frac{2}{5}$.
5. \$6400.
6. \$17.50.
7. \$1000; \$50.
8. \$1180; \$2360.
9. 1 $\frac{1}{2}$ cu. ft.
10. 39 $\frac{9}{10}$ rods.
11. 12 $\frac{1}{8}$ rods.

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12. $\frac{1}{2}$; $\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{5}$;
2 $\frac{1}{2}$ days.
13. $\frac{1}{4}$; 2 $\frac{1}{4}$ days.
14. 3 $\frac{1}{2}$ days.
15. 3 $\frac{1}{2}$ days.

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6. 0.234; 54.1666.
7. 10.582; 0.0083.
8. 0.00074; 0.005389.
9. 16.033; 0.426243.
10. 0.647.

- Ex. Ans.
 11. 600.047.
 12. (1) 2.206.
 (2) 0.0936.
 (3) 54.054.
 (4) 806.001047.
 (5) 500.26.
 (6) 0.001006.
 (7) 0.000029.
 (8) 8.46291.
 (9) 0.511.
 (10) 4271.0004271.
 (11) 68000.4½.
 (12) 0.122.
 (13) 8.04½.
 (14) 500 0¾.
 13. 6.2; 5.86; 0.067;
 9.009.
 14. —.
 15. 4.8; 0.87½; 0.062½.
 16. —.
 17. 6.0; 6.00; 6.000.
 18. 0.700; 0.700000.
 19. 6.70; 460.0.

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20. —.
 21. $\frac{1}{3}; \frac{2}{5}; \frac{1}{20}; \frac{3}{20}; \frac{1}{4}; \frac{3}{4}$.
 22. $\frac{1}{4}; \frac{3}{8}; \frac{3}{8}; \frac{7}{8}; \frac{3}{8}$.
 23. 0.2.
 24. 0.7½.
 25. 0.6½.
 26. 0.3½.
 27. 0.35.
 28. 1.2½.
 29. 7.5.
 30. 0.125.
 31. 0.375.
 32. 0.875.
 33. 0.16½.
 34. 0.833½.
 35. \$0.25; \$0.15;
 \$0.16; \$0.14.
 36. 75¢; 12½¢; 6½¢;
 8½¢; 33½¢;
 66½¢.

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37. 116.02.
 38. 93.46.

- Ex. Ans.
 39. 75.085.
 40. 274.373.
 41. 703 61.
 42. 47.9231.
 43. 45.3471.
 44. 68.4986.

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45. 13.75.
 46. 6.783.
 47. 0.178.
 48. 1.955.
 49. 6.534.
 50. 0.0891.
 51. 1.636.
 52. 67.644.
 53. 10.0594.
 54. 0.1818.
 55. 24.50987.
 56. 0.1101.
 57. \$0.73.
 58. \$0.875.
 59. 7.525 lb.
 60. 296.42 acres.
 61. 323.21 acres.

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62. 3.6; 0.36; 0.036.
 63. 14 4; 1.44; 0.288.
 64. 112.5; 31.25; 1750.
 65. \$1.50; \$2.00;
 \$1.75; \$2.00.
 66. 5280 ft.

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67. 1.8; 0.18; 0.45.
 68. 7.2; 0.96; 0.096.
 69. 3; 0.3; 30.
 70. 46.4.
 71. 8.12.
 72. 187.77.
 73. 31.8.
 74. 34.2.
 75. 89.88.
 76. 42.28.
 77. 3.1542.
 78. 650,176.88.
 79. 0.015035.
 80. 5.005.

- Ex. Ans.
 81. 3169.44.
 82. 0.00585.
 83. 0.042016.
 84. \$6.25; \$15.
 85. \$200; \$500.
 86. \$23.437½.
 87. \$6.25; \$33.33.
 88. 4840 sq. yd.
 89. \$5.166.
 90. \$49.8816½.

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91. 0.52. 93. 6.07.
 92. 32.1. 94. 0.197.
 95. 22.568.
 96. 109.5125.
 97. 10.2581.
 98. 0.541.

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99. 0.792½.
 100. 31.4.
 101. 146.5.
 102. 231 75.
 103. 90.125.
 104. 480 111½.
 105. 267 83½.
 106. 499.263½.
 107. 468 619½.
 108. 352.571½.
 109. \$0.87½.
 110. \$19.50.
 111. 7.166½ lb.
 112. \$0.193.
 113. \$0.482½.

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114. 450.
 115. 107.625.
 116. 185.052...
 117. 1.433...
 118. 5.307.
 119. 1,000,000.
 120. 1268.873...
 121. 0.120...
 122. 134.491...
 123. 0.143...
 124. 100 tops.

- Ex. Ans.*
 125. 6.0606...
 126. 2; 7; 10; 24.
 127. 40 mi.
 128. 22.860 meters.
 129. 127.551... cu. in.

Page 184.

1. \$89.10.
2. \$343.88.
3. 8143 gal.
4. 67.5 tons.
5. 22.12 lb.
6. \$3750.
7. 2355 bu.
8. 8750 cattle.
9. \$360.
10. \$467.50.

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11. \$5.44.
12. 1882.4 gal.
13. 6% of \$1995;
\$2.40.
14. \$188.
15. \$540.
16. \$332.12.
17. 257.6 lb.
18. \$6; \$300.
19. 2700.
20. \$108.
21. 10¢; 11¢; 9½¢;
\$24.60.

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1. \$6237.
2. \$9850.
3. 8960 lb.
4. 2250 ft.
5. \$46.
6. \$75,000.
7. \$20.00.
8. \$9.60.
9. 2400 sheep.
10. \$4000.
11. \$300.

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12. \$430.
13. 12 years.

- Ex. Ans.*
 14. 50 ft.
 15. \$4.00.
 16. \$750.
 17. \$400.
 18. \$257.60.
 19. 800 bu.
 20. 450 acres.
 21. 128 lb.
 22. 2976.
 23. 780.
 24. 60 shares.
 25. \$5400.
 26. \$800.
 27. \$20.00.

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1. 17%.
2. 16½%.
3. 7½%.
4. 94½%; 98½%.
5. 6%.
6. 5%.
7. 36¼%; 27¾%;
20¾%; 14½%.
9. 15%.
10. 12¾%.
11. 6½%.
12. 10⅞%.

Page 191.

1. \$35 gain.
2. \$0.18.
3. \$1.62.
4. \$56.25.
5. \$2.10.
6. 21½%.
7. 16%.
8. 25%.
9. 20%.
10. \$1800.
11. \$5000.
12. \$60; \$90; loss
\$6 greater.
13. \$24.
14. \$558.

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15. \$106.25.
16. \$67.64.

- Ex. Ans.*
 17. \$7.61.
 18. \$6500.
 19. \$440.
 20. \$103.
 21. \$449.23.
 22. \$352.26.

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23. \$1073.20.
24. \$3291.75.
25. \$324.47.
26. \$3.40.
27. 25% gain.
28. 20% loss.
29. 20% gain.
30. 16⅔% loss.
31. \$1025.
32. \$490.
33. \$6.75.

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34. \$3900.
35. \$1025.
36. 1½%; \$72.36.
37. \$13.75.
38. \$88.27.
39. \$1837.50.
40. \$486.65.
41. A, 34%; B, 30%;
C, 36%.
A, \$183.60; B,
\$162; C, \$194.40.
42. 24%; 36%; 40%.

Page 196.

1. \$50.76.
2. \$219.84.
3. \$193.71.
4. \$111.68.
5. \$256.
6. \$33.48.
7. \$47.43.
8. \$124.72.
9. \$718.39.
10. \$1158.11.

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11. \$4.60.
12. \$27.76.

Ex.	Ans.
13.	\$26.25.
14.	\$97.23.
15.	\$429.
16.	\$280.
17.	\$4.43.
18.	\$115.75.
19.	\$275.
20.	\$1.12.
21.	\$69.19.
22.	\$7.39.
23.	\$150.
24.	\$88.39.
25.	\$8.81.
26.	\$21.33.
27.	\$47.51.
28.	\$78.94.
29.	—.
30.	\$28.80.
31.	\$64.60.
32.	\$209.80.
33.	\$62.10.
34.	\$31.29.
35.	\$104.06.
36.	\$12.24.
37.	\$134.25.

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38.	\$0.52.
39.	\$1.18.
40.	\$1.00.
41.	\$4.00.
42.	\$1.22.
43.	\$4.00.
44.	\$8.76.
45.	\$14.80.

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46.	\$0.07.
47.	\$0.31.
48.	\$0.27.
49.	\$4.57.
50.	\$1.77.
51.	\$1.36.
52.	\$3.51.
53.	\$5.21.

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54.	\$26.98.
55.	\$191.33.

Ex.	Ans.
56.	\$15.49.
57.	\$3.68.
58.	\$748.90.
59.	\$1568.75.
60.	\$143.87.
61.	\$589.00.
62.	\$1638.08.
63.	\$31.94.
64.	\$826.
65.	\$10,350.
66.	\$316.50.
67.	\$438.
68.	\$50,750.
69.	\$230.61.
70.	\$96.07.
71.	\$92.63.
72.	\$953.15.
73.	\$875.44.

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74.	\$609.22.
75.	\$1129.38.
76.	\$52.02.
77.	\$95.25.
78.	\$4984.35.
79.	\$7175.57.
80.	\$488.02.
81.	\$996.49.
82.	\$543.21.
83.	\$165.43.

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84.	\$38.61.
85.	\$157.85.
86.	\$121.06.
87.	\$20.80.
88.	\$24.75.
89.	\$818.75.
90.	\$1226.65.
91.	\$2075.75.
92.	\$695.60.
93.	\$0.83.
94.	\$2.22.
95.	\$0.75.
96.	\$34.72.
97.	\$20.25.
98.	\$3.50.
99.	\$6.78.
100.	\$8.25.

Ex.	Ans.
101.	\$19.00.
102.	\$5.56.
103.	\$38.00.

Page 203.

104.	2 y. 4 m. 8 d.
105.	6 y. 3 m. 10 d.
106.	2 y. 2 m. 11 d.

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107.	11 m. 10 d.
108.	4 y. 12 d.
109.	2 y. 3 m.
110.	4 m. 15 d.
111.	9 m. 10 d.
112.	1 y. 1 d.
113.	\$49.64.
114.	\$162.50.
115.	\$1017.
116.	\$72.44.
117.	\$7617.20.
118.	\$216.67.
119.	\$710.79.
120.	\$1000 ;
	\$1000.
121.	\$4000.

Page 205.

122.	\$59.31.
123.	\$3999.48.
124.	\$828.76.
125.	\$826.31.
126.	\$214.63 ;
	\$236.30.

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127.	\$315.02.
128.	\$612.52.
129.	\$1276.28.
130.	\$504.99.

Page 208.

131.	Dis. \$1.38 ;
	Pro. \$248.63.
132.	Dis. \$8.40 ;
	Pro. \$791.60.

- Ex. Ans.**
 133. Dis. \$7.75;
 Pro. \$492.25.
 134. Dis. \$7.88;
 Pro. \$742.12.
 135. Dis. \$12.30;
 Pro. \$687.70.
 136. Dis. \$30.50;
 Pro. \$969.50.
 137. Dis. \$14.73;
 Pro. \$935.27.
 138. Dis. \$30.60;
 Pro. \$1169.40.
 139. Dis. \$2.75;
 Pro. \$497.25.
 140. Dis. \$7.25;
 Pro. \$682.75.
 141. Dis. \$5.83;
 Pro. \$1494.17.

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142. Dis. \$21.14;
 Pro. \$803.86.
 143. Dis. \$16.75;
 Pro. \$178.25.
 144. Dis. \$10.50;
 Pro. \$514.35.
 145. Dis. \$21.00;
 Pro. \$1379.00.

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11. $99\frac{1}{2}$ sq. yd.
 12. \$99,000.
 13. \$125.00.

Page 212.

14. 107 sq. yd.
 15. 26,136 sq. ft.
 16. 43,560 sq. ft.;
 16,335 sq. ft.
 17. $\frac{62\frac{1}{2}}{728}$ of an acre.
 18. —
 19. $1\frac{1}{4}$ sq. ft. 24 sq.
 in.
 20. 32 sq. in.; 8 sq.
 in.; 16 sq. in.;
 112 sq. in.
 21. 6750 bricks;
 \$70.88.

- Ex. Ans.**
 22. $111\frac{1}{2}$ sq. ft.
 23. 30 sq. yd.
 24. 20 sq. ft.
 25. 288 sq. rd.;
 $1\frac{1}{4}$ acres.
 26. 160 sq. rd.; 52 rd.;
 56 rd.; 74 rd.

Page 213.

27. 91 sq. in.
 28. $31\frac{1}{2}$ sq. ft.

Page 214.

30. 30 sq. in.
 31. 216 sq. ft.
 32. 1110 sq. ft.
 34. 144 sq. in.
 35. $21\frac{1}{2}$ sq. ft.

Page 215.

36. 13 in.;
 $21\frac{1}{2}$ sq. ft.

Page 216.

37. 482.8 sq. in.
 38. 61.95 sq. in.
 39. 259.8 sq. in.

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40. $47\frac{1}{2}$ in.
 41. $25\frac{1}{2}$ ft.
 42. $9\frac{1}{11}$ ft.

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43. $4\frac{5}{8}$ sq. ft.
 44. $86\frac{5}{8}$ sq. ft.
 45. $34\frac{3}{4}$ sq. yd.
 46. 11 ft. $6\frac{1}{11}$ in.
 47. 420 times.
 48. $17\frac{3}{4}$ in.
 49. 21 ft.
 50. 4.33 in. high;
 10.825 sq. in.
 51. 876.825 sq. ft.
 52. 93.528 sq. in.
 53. $\frac{1}{11}$.

- Ex. Ans.**
Page 219.
 54. 98 sq. in.
 55. 1st = 4 times 2d.
 56. 1st = 9 times 2d.
 57. $78\frac{1}{2}$; $314\frac{1}{2}$; 4; 1t is.
 58. 1st = 9 times 2d.

Page 221.

62. 462 cu. in.
 63. 720 cu. in.
 64. 3000 lbs.
 65. $2\frac{1}{2}$ cd.
 66. $1\frac{1}{2}$ cd.

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67. 132 ft.
 68. $17\frac{1}{2}$ ft.
 69. 175 ft.
 70. 213.31 cu. in.

Page 224.

71. 288 cu. in.
 72. 1461.375 cu. in.

Page 225.

73. 1239 cu. in.
 74. 1496.448 cu. in.
 75. 1764 cu. in.
 76. 40,000 cu. ft.
 77. $1571\frac{1}{2}$ cu. in.
 78. $16\frac{1}{2}$ gal.
 79. $3\frac{1}{2}$ qt.
 80. $117,551\frac{1}{8}$ gal.
 81. $\frac{1}{4}$ cu. ft.; $5\frac{1}{8}$ gal.

Page 226.

82. $2151\frac{1}{2}$ cu. in.
 83. $10\frac{2}{3}$ gi.

Page 227.

84. $523\frac{1}{7}$ cu. in.
 85. 1000 cu. in.
 86. —
 87. $24,438\frac{6}{7}$ cu. ft.
 88. $5657\frac{1}{2}$ sq. ft.
 89. $452\frac{4}{5}$ sq. ft.
 90. $29\frac{1}{2}$ lb.
 91. $15\frac{1}{4}$ qt.

